The Effect of Selected Biostimulating Substance on the Degradation in the Rumen

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Abstract
The cows with the canulla were divided into two groups - experimental and control. One cow was added to experimental product Biopolym FZT, second Biopolym granules. The samples of rumen fluid and feces were analyzed. The growth of microorganisms in the rumen fluid of experimental animals means the possibility of a positive impact of Biopolym on the degradation of feeding the rumen.

Keywords: Ascophyllum nodosum, rumen, Biopolym

1. Introduction

Cattle production is increasingly driven by efforts to increase performance of cows and make the production the most economic. Dairy cows efficiently convert forage to provide milk important for human nutrition as a source of essential amino acids, minerals, vitamins. One of the factors affecting the milk production is the nutrition of the cows. An adequate diet is represented by a sufficient supply of energy, nitrogen compounds and vitamins. Important role of additive substances is to improve milk efficiency, resistance and reproduction of the cows. Due to discussed environmental problems the effort is placed on using additives derived from nature. The aim of this study was to verify the effect of the biostimulating substance Biopolym on the activity and multiplication of rumen micro flora as a source of full protein for dairy cows. Rumen is de facto a complex and unique microbial ecosystem, where a very diverse collection of micro flora can be found. In digestion of nutrients prokaryotic bacteria, eukaryotic protozoa and fungi participate. Protozoa are part of a complex ruminal population and are essential for the nutritional well-being and productivity of the host ruminant. Over 30 different genera (nearly 300 species) of protozoa from the rumen ecosystem have been described since their initial discovery nearly 150 years ago. Although rumen protozoa do not form a monophyletic unit, all of them belong to the substrain of *Intramacronucleata*, *Litostomatea* classes, subclasses *Trichostomatia* [1]. Rumen protozoa can be divided into two morphologically different groups. The cells of *Holotricha* are fully covered by cilia. Rumen protozoa in suborder *Entodiniomorphina* have their cells covered by cilia in bunches or belts [2].

Rumen protozoa play several roles in the rumen. Some of them are major predators of bacteria (*Entodinium*), others feed on other types of ciliates (*Polyplastron*). Ciliates are able to absorb particles of cellulose and so participate in its digestion. Some of the *Holotrich* protozoa prefer starch intake depriving bacteria of the relevant substrate, its fermentation resulting in a reduction of pH [3].

Rumen ciliates have a major impact on stabilization of the rumen ecosystem. Although ruminants suffering from rumen ciliates do not show visible problems [1], their absence leads to

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significant changes in the composition of bacterial microflora. It resorts to decreasing pH due to increasing production of organic acids by fermentation.

To support the growth and multiplication of rumen microflora as a source of full protein for cows a number of biostimulation agents, including algeens is currently tested

Bio-algeens are hydrolysates of brown seaweed *Ascophyllum nodosum*, obtained in coastal waters around Iceland and the beaches of Northern Scotland. Due to its chemical composition (vitamins, essential amino acids, minerals) a range of products made from seaweed has found application in human and veterinary medicine – in gastroenterology, gynecology, traumatology, dermatology and in dental surgery [4, 5, 3].

Beside the nutritional importance algeens have great deodorant and detoxication abilities [4]. They contain a number of polysaccharides such as polyuronic acids, which are able to absorb many harmful and toxic substances.

Bio-algeens can be used with success everywhere when positive action of desirable microorganisms it sought [6]. The principle of the positive effect observed is caused by the chemical composition that makes optimal environment for fast development of the microflora, decomposing various organic materials in the rumen to biogas [6, 4].

One of the many Bio-algeen products imported to the Czech Republic is Biopolym. Liquid Biopolym FZT is designed for dosing in drinking water. It is a dark brown liquid with a characteristic smell of marine products, which pH value is around 12. In practice the product is dosed in water with a membrane pump. Biopolym granulate is applied to dry feed. It consists of brown to black granules size 1-2 mm.

Biopolym has been tested in many countries. For example in the stables and sow fattening plants of firm Guazamara – Cuevas de Almanzora (Almeina – Spain) it was found that a 60% reduction of ammonia emission is achieved for piglets after the application of Biopolym FZT [7].

In an experiment conducted in Germany in the fattening chicken broiler plant the usage of Biopolym FZT was found to cause an average reduction of ammonia emissions of 40% [8].

2. Materials and methods

An experiment verifying the effect of Biopolym on degradation in the rumen was conducted at the school farm of the University of South Bohemia in České Budějovice. Four Holstein dry cows equipped with a canulla were used for the experiment. The cows are fed meadow hay ad libitum and 2 kg of wheat meal. The animals were divided into control and experimental groups. 24 ml of liquid Biopolym FZT was added into meal for one of the experimental cows, 24 g Biopolym granulat into meal for another. Before the experiment there was a preparatory period. The samples of the rumen liquid were then collected. The content of volatile fatty acids was determined by the electrophoretic method on the instrument Ionosep 2001. Ruminal ciliate protozoa numbers were determined using a 0.1-mm depth Bürker counting chamber. The rumen ammonia concentration was determined by acidimetric titration. The experimental period started on October 11 2010.

3. Results and discussion

Observed results of the fatty acids content for the entire period are shown in Figures 1 to 3. The fatty acids content did not change significantly during the experimental period. However, drastic changes of fatty acids content would have resulted in a change of pH which in its turn could be dangerous to the health of the cows [9]. The observed lactic acid content was negligible compare to other volatile fatty acids.

The results of rumen ammonia concentration are shown in Figure 4. Ammonia is a weak base (pH 8.8) partially dissociated in solution. There is a balance between NH_3 and NH_4^+ in a 40°C solution [10], where the form of ammonia depends on the pH of the rumen liquid. The optimum level for microbial protein synthesis is achieved when rumen ammonia concentration is about 3,5mmol/l [11]. During the experiment the ammonia content in experimental group increased and then fluctuated around this value.

The rumen protozoa content is shown in Figures 5 and 6. The numbers found using the Bürker counting chamber were multiplied by 10.000, thus displaying the real concentration of rumen protozoa in 1 ml of the rumen liquid. The results verify a positive effect on the growth of rumen

micro flora, as predicated by [2].Except for ciliates, most bacteria participate in feed rumen degradation. Bacteria content cannot be determined under common conditions.

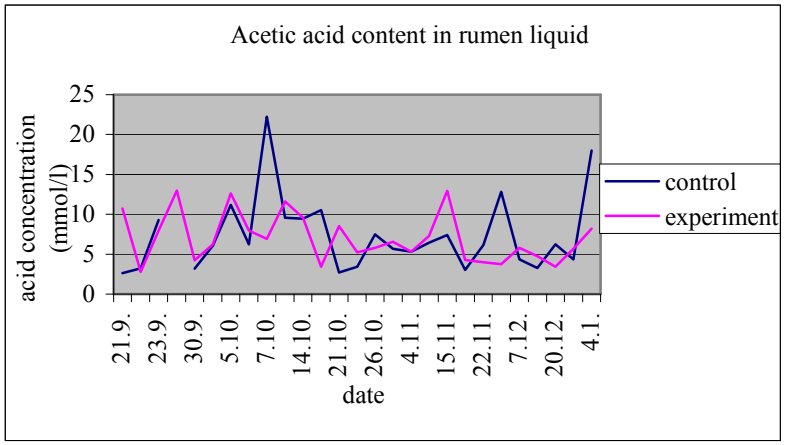

Figure 1: Acetic acid concentration in rumen liquid

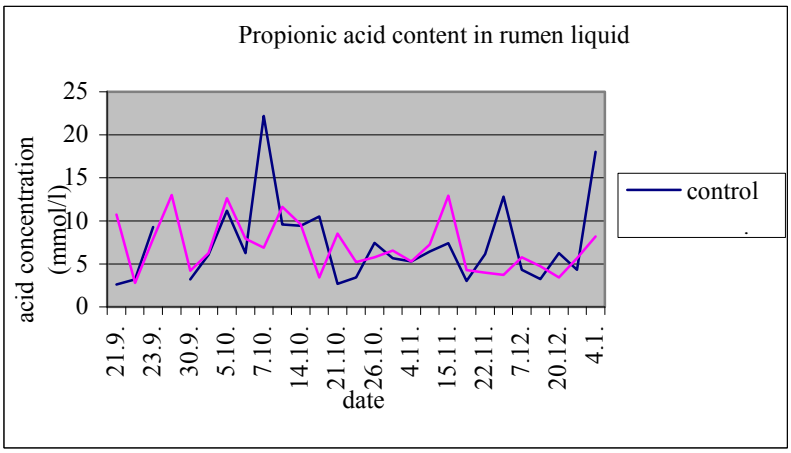

Figure 2: Propionic acid concentration in rumen liquid

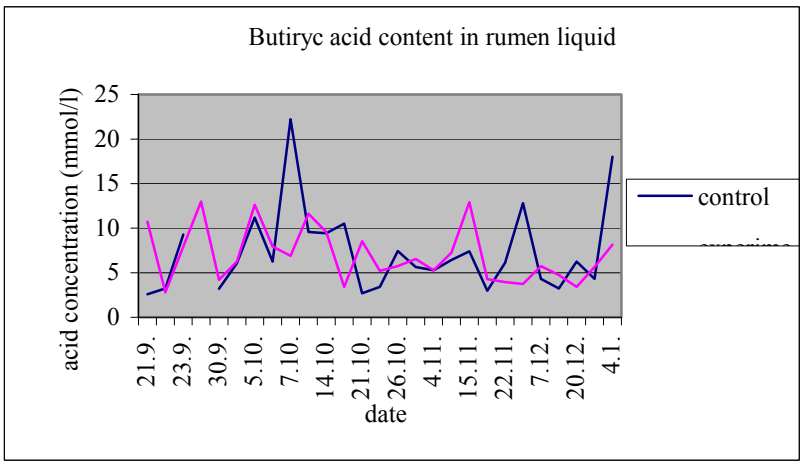

Figure 3: Butiryc acid concentration in rumen liquid

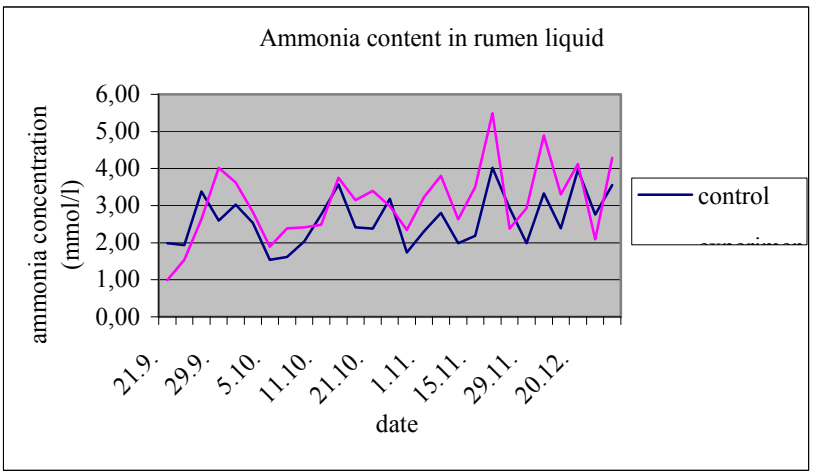

Figure 4: Ammonia concentration in rumen liquid

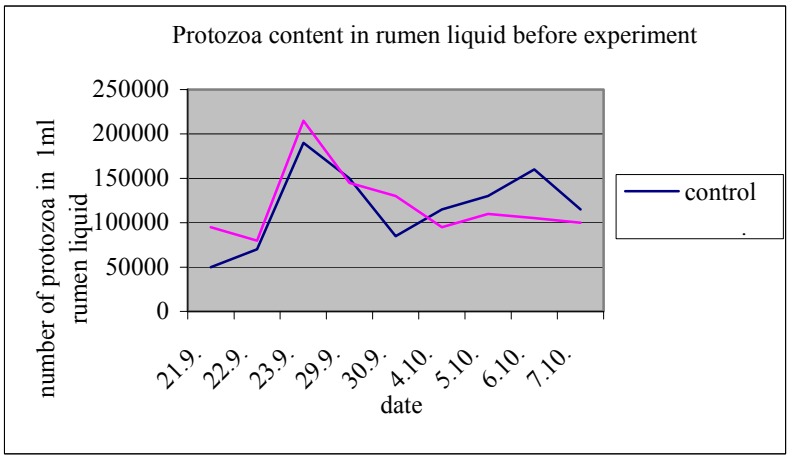

Figure 5: The number of protozoa in rumen liquid before an experiment

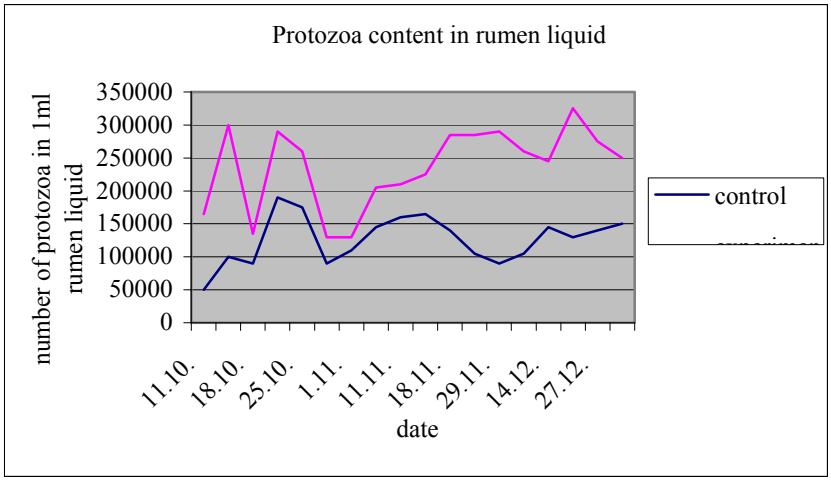

Figure 6: The number of protozoa in rumen liquid during the experiment

4. Conclusions

In this work the influence of Biopolym in rumen degradation was studied and rumen liquid was analysed. The number of rumen protozoa increased after the application of the tested substance. The increase of rumen microorganisms means an increasing in protein important for feeding of cows. The experiment still continues and samples are collected for further analyses of amino acids content.

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References

1. Hausmann, K., Hülsmann, N., Protozoologie. Academia, Praha, 2003, 347
2. Williams, A. G., Rumen holotrich ciliate protozoa. Microbiological Rew., 1986, 50, 25 – 49
3. Vostoupal, B., Jelínek, A., Plíva, P., Dědina, M., Gjurov, V., Bioalginát y v roli významného detoxikačního média. Sborník příspěvků z 6. konference s mezinárodní účastí konané na téma „Využití doplňkové a nekonvenční péče o zdraví zvířat“ ZF JU České Budějovice, 2006, 16. – 17, 6, 138 – 144
4. Gjurov, V., Šoch, M., Novák, P., Vostoupal, B., Vráblíková, J., Zajíček, P., Biotechnologické přípravky kategorie BIO-ALGEEN v chovech hospodářských zvířat, pro bioplynové stanice a pro čistírny odpadních vod. Sborník příspěvků z vědecké konference s mezinárodní účastí, pořádané na téma “Aktuální otázky bioklimatologie zvířat“, konané dne 11. prosince 2007 v Brně. Vydal VUŽV Praha, 2007, 33 - 40, ISBN - 978-80-86454-96-2
5. Perry, T. W., Feed Formulations. Danville, Illinois, USA, The Interst. Print. and Publish, 2002, 380
6 Bartoš, S., Mikrobiologie a biochemie trávení v bachoru přežvýkavců. Praha, 1982, 81-82
7. Schulze & Hermsen GmbH., Nitrogen reduction and pig slurry amount for purpose of necessary acreage reduction in pig production by means of the granulate Biopolym FZ. Guazamara – Cuevas de Almanzora, Schulze and Hermsen, 2002, 1–6
8. Hörnig G., Brunsch R., Additive to drinking water reduces emissions from broiler stables. Bornim, 1999, ATB, 1–8
9. Kudrna, V., a kol.: Produkce krmiv a výživa skotu, Agrospoj, Praha, 1998, 305
10. Jelínek, P., Koudela K., a kol.: Fyziologie hospodářských zvířat. MZLU, Brno, 2003, 120
11. Nikolič, J.A., Jovanič, M., Filipovič, R., Microbial protein syntesis by bovine rumen content in relation to ammonia concentration. Tracer Studies on Non-Protein Nitrogen for Ruminants. Vienna, 1975, 2, 43