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THE EFFECT OF SOME PROBIOTIC PREPARATIONS ON CALVES' GROWTH

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Summary

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The experiments were carried out at the Practical Training and Experimental Center of the Lithuanian Veterinary Academy with Lithuanian Black & White calves. The effect of probiotic preparations YEASTURE, MICROBOND and LACTURE, produced by "Cenzone" (USA) on 1–6 months old calves' growth was studied. Two kilograms of the probiotic preparations were mixed with 1 tonne of the concentrates for experimental animals. The average weight gain of calves, given YEASTURE, MICROBOND and LACTURE was respectively by 8.9, 3.3 and 6 % higher than in the control group. The digestibility of diet nutrients was improved as followed: for dry matter – by 0.95%, 0.8% and 1.45%, for organic matter – 0.85%, 0.62% and 2.03%, fat – 0.55 %, 1.23% and 2.57%, protein – 1.86%, 0.92% and 1.02%, fiber – 2.0%, 0.8% and 1.3% for YEASTURE, MICROBOND and LACTURE, respectively. These probiotic preparations had no negative effect on the physiological status of calves. The haematological parameters varied within the physiological range and indicated a good physiological status of calves. The probiotic preparations studied enhanced the immune system of the calves.

The results of the control slaughter and meat quality clearly demonstrated that the probiotics YEASTURE and MICROBOND had no significant effect on the carcass output and the coefficient of succulence. A tendency towards decreased humidity (by 1.08% and 2.16% respectively) and higher amount of fat (by 0.52% and 1.22% respectively) was observed. The gustatory characteristics of the meat improved.

Key words: calves, carcass output, digestibility, LACTURE, meat quality, MICROBOND, probiotics, weight gain, YEASTURE

INTRODUCTION

The profitability of milk and cattle meat production greatly depends on calves' growth several months after birth. Only healthy calves grown under favourable conditions can develop into highly productive cows and/or give a high weight gain if they are grown for meat production. Subsequently, changes in farming forms and economical condition cause changes in technologies.

Peculiarities of the digestive tract of newborn ruminants enable scientists to look for new forages and supplements which could substitute milk without any loss in growth intensity. Adequate feeding can be ensured only when animals are optimally supplied with all necessary nutrients. It is of primary importance that all nutritive substances given with forage would be fully assimilated and used for production. Nowadays a number of microbial preparations – probiotics, devel-

oped on the basis of viable microorganisms from the digestive tract – are being proposed to stimulate the activity of the digestive system. These preparations are considered to be ecological, multicomponent products, which contain enzymes, vitamins and amino acids synthesized by microorganisms during the process of propagation. They are able to improve the microbiological balance in the digestive tract and enhance the immune system of the animals. They remain one of the ways to achieve a faster digestibility of plant origin forages, a better assimilation of protein and other nutritive plant substances (Bendikas and Uchockis, 2000; Kersnauskas *et al*., 1999; Meile *et al.*, 2001).

Formation of microbiological populations unavoidably starts in the digestive tract of warm-blooded animals soon after birth and remain in the digestive tract during the whole life of the animal. Most of these bacterial species are sensitive to changes in the digestive tract. Microorganisms can finally colonize the intestine only if the digestive tract is able to ensure a favourable temperature, a constant supply with nutrients, biologically active substances and fluid. In this case the profit is mutual: microorganisms have favourable conditions for the development and they prevent the animal from the diseases.

Generally, two different types of bacterial populations exist in the digestive tract. The first one is closely related to the epithelium of the digestive tract, the second is commonly found in the content of the intestine. The populations which easily occupy the digestive tract can be both useful and harmful. In case of useful bacterial populations the effect on the organism is positive. The most beneficial is the case when particularly useful bacterial species occupy the digestive tract and these populations are maintained during the whole life of the animal. Consequently, the maintenance of this peculiar microbiological balance requires the creation of favourable environment in grown animals, that is quite difficult in natural conditions. However, the supply of necessary microorganisms with forage and forage supplements helps to ensure the maintenance of such specific microbiological balance (Asahara *et al.*, 2001; Bezkorovainy, 2001; Tarakanov, 1999, 2000).

A lot of studies evidently demonstrate that probiotics are considered to be the preparations of the future, which have been insufficiently studied yet and the application of which seems to be rather promising. Therefore, the investigations upon them still remain of primary importance in both scientific and practical aspects. (Klaenhammer, 2000; Sheveleva, 1999).

The experiments with probiotic preparations YEASTURE, MICROBOND and LACTURE have never been carried out in Lithuania and there are no data about their effect on calves‘ growth, physiological status, meat properties and meat quality. The data about the effect of these probiotics on animal meat quality and growth are rather limited and we didn't find any data about their effect on meat quality in the references studied. Therefore, the respective experiments carried out with these products seem to be quite interesting and valuable from a scientific and practical points of view.

Our experiments aimed to study the effect of probiotics YEASTURE, MICROBOND and LACTURE on calves‘growth, physiological state and meat quality.

MATERIALS AND METHODS

In order to determine the effect of probiotics on calves’ growth and meat quality

three experiments were carried out at the Practical Training and Experimental Center of Lithuanian Veterinary Academy with Lithuanian Black&White calves. Control and experimental groups were formed according to the principle of analogous, taking into account animal age, origin, gender and body weight. Each of the groups contained 15 one-month old animals (8 bulls and 7 heifers). Animals were kept in one stall. The animals of all groups were fed the same ration, but the animals of the experimental groups were given the probiotic YEASTURE during the first experiment, MICROBOND – during the second, and LACTURE – during the third, added to the ground grain mixture (barley, oat, rye in equal proportions), according to the recommendations given by the concern-producer "Cenzone" (USA), in ratio 2 kg/tonne, for 5 months.

The probiotic preparation YEASTURE contains *Saccharomyces cerevisiae* (min. 10.0 billions CFU/kg), *Lactobacillus casei, Lactobacillus acidophilus and Streptococcus faecium* (min. 10.0 billions CFU/kg), *Bacillus subtilis* (min. 10.0 billions CFU/kg).

The probiotic MICROBOND contains *S. cerevisiae* (min. 10.0 billions CFU/kg), *L. acidophilus* and *Str. faecium* (min. 5.0 billions CFU/kg), *B. subtilis* (min. 5.0 billions CFU/kg), selenium and chromium.

The Probiotic LACTURE contains *S. cerevisiae* (5.0 billions cells/kg), *L. acidophilus* (77.0 billions CFU/kg), *Str. faecium* (44.0 billions CFU/kg), *B. subtilis* (2.2 billions CFU/ kg).

The animals in the farm were fed according to the scheme providing 750–800 g daily weight gain. The calves were fed twice daily, water was given ad libitum, supplying it from automatic drinkers. Milk ration was formed individually, other forage ration - for groups. During the first and second months of the experiments hay was given ad libitum, later – as ground grain mixture in normalized doses. Hay was only of good quality, produced from the grass of cultural pastures, cut before blossoming and fully desiccated. The ration for calves was formed of: 31.7 % whole milk, 18.6 % hay, 11.2 % haylage, 38.5 % ground grain mixture. One calf was fed 430 kg of whole milk, 166 kg of ground grain mixture, 182 kg of hay, 185 kg of haylage. On the average the animals were given 4551 AE MJ metabolizable energy and about 46.0 kg digestive proteins.

The calves were weighed once monthly; an average daily weight gain was calculated. Forage organic matter digestibility and haematological parameters were analyzed at the end of the experiment (for 6 month old calves). The digestibility of forage nutritional substances was established using TiO_2 indicator. The following parameters were determined in forage and faeces: total amount of nitrogen, protein and non-protein nitrogen by Kjeldal, dry matter amount – by drying at 100–105°C ; ash – by burning of forage and faeces organic matter at 500–600°C; crude fat – by using Sokslet method; crude fiber – by using Kurshner method (Mikulioniene, 2000). Erythrocytes and leukocytes were counted in Goriajev chamber, the amount of haemoglobin was measured by colorimetric – haematic method of Sahli, total protein in blood serum – by refractometry (Kondrahin *et al.*, 1985).

At the end of the first and the second experiments 10 calves from each group which highly corresponded to the average parameters of the group were selected and the control slaughter was done. The carcass output, chemical composition of and physico-chemical properties (pH, color

intensity, water holding capacity, softness, boiling loss and protein value) of *m. longissimus dorsi* were studied. Meat quality was defined according to the generally accepted methods (Warris, 2000; Zhuravskaya *et al.*, 1985). The data were statistically evaluated according Student's method (Lakin, 1980).

RESULTS AND DISCUSSION

The dynamics of animal growth and the average daily weight gain are presented in Table 1.

The data presented in the table evidently demonstrated that the animals from experimental groups grew faster than those from the control groups. The average daily weight gain of the calves from experimental groups, given probiotics YEASTURE, MICROBOND and LACTURE, was respectively 74, 29, and 47 g or by 8.9, 3.3 and 6 % higher vs the control group. Due to the effect of probiotic YEASTURE, the weight gain during the three months after birth was by 19.8% higher than in animals from the respective control group. During the next two months of experiments the effect of this preparation was not significant. Probiotic MICROBOND during the first three months of experiments increased calves' body mass by 7.3% while during the following month it had no effect. Due to the effect of the preparation LACTURE as

Table 1. Dynamics of calves' growth in calves (n=15) treated via feed with probiotic preparations YEASTURE, MICROBOND and LACTURE (2 kg/tonne) from the 1st till the 6th month of age (experimental) and untreated (controls). Data are presented as mean ± SEM

Group	Calves' age and mass, kg						Average daily weight gain, g
	1 month	2 months	3 months	4 months	5 months	6 months	
Experiment 1 - YEASTURE							
Control	42.8 ±2.59	59.7 ±3.08	80.0 ±3.72	102.3 ±3.36	130.3 ±5.30	167.0 ±7.48	828.0 ±24.13
Experimental	42.7 ±2.86	61.7 ±3.04	88.0 ±3.58	114.0* ±4.51	141.0 ±6.51	178.0 ±8.35	902.0* ±19.61
Experiment 2 – MICROBOND							
Control	43.2 ±1.83	67.6 ±7.76	96.7 ±3.41	122.9 ±3.87	150.9 ±5.96	176.0 ±6.75	885.0 ±34.17
Experimental	41.9 ±1.96	70.1 ±3.04	99.4 ±3.21	127.4 ±4.03	155.2 ±6.11	179.0 ±7.02	914.0 ±41.53
Experiment 3 – LACTURE							
Control	38.2 ±1.07	56.5 ±2.40	77.5 ±3.15	101.3 ±4.08	127.8 ±4.93	155.3 ±7.10	780.0 ±38.14
Experimental	38.0 ±0.95	56.8 ±1.89	80.0 ±2.76	104.8 ±4.69	133.5 ±5.12	162.0 ±6.85	827.0 ±27.58

* $P<0.05$ between groups in each experiment.

Table 2. Digestibility of nutrients (%) in calves (n=15) treated via feed with probiotic preparations YEASTURE, MICROBOND and LACTURE (2 kg/tonne) from the 1st till the 6th month of age (experimental) and untreated (controls). Data are presented as mean ± SEM

Group	Dry matter	Organic matter	Protein	Fiber (CF)	Fat
Experiment 1 − YEASTURE					
Control	69.25 ±0.87	70.57 ±0.56	72.02 ±0.83	55.40 ±0.83	50.63 ±0.27
Experimental	70.2 ±0.41	71.42 ±0.58	73.88 ±0.78	57.40 ±0.92	51.18 ±0.39
Experiment 2 − MICROBOND					
Control	67.40 ±0.76	68.40 ±0.63	70.60 ±0.62	53.90 ±0.76	44.68 ±0.83
Experimental	68.20 ±0.31	69.02 ±0.71	71.52 ±0.59	54.70 ±0.83	45.91 ±0.41
Experiment 3 − LACTURE					
Control	67.43 ±0.62	68.22 ±0.77	70.68 ±0.59	53.90 ±0.71	43.40 ±0.57
Experimental	68.88 ±0.78	70.25 ±0.63	71.70 ±0.43	55.20 ±0.59	45.97 ±1.08

during the first, second and third month as well as during the following two months the calves‘ body mass was by 5.9% higher than that of the respective control group, although statistically insignificantly. It could be concluded from the experiments that the application of probiotics YEASTURE and MICROBOND caused higher differences in calves' body mass vs the controls during the first three months while the probiotic LACTURE – till the sixth month of age.

Data for ration organic matter digestibility are presented in the Table 2. These data evidently demonstrated a better organic matter digestibility in the experimental groups compared to controls. Due to the effect of probiotics YEASTURE, MICROBOND and LACTURE dry matter digestibility showed a tendency towards increase by 0.95, 0.8 and 1.45% respectively, the organic matter – by 0.85, 0.62 and 2.03%, the fat – by 0.55, 1.23 and 2.57%, the protein – by 1.86, 0.92 and 1.02% and the fiber – by 2.0, 0.8 and 1.3% respectively.

It can be concluded from the results obtained, that the microorganisms from the preparation YEASTURE caused a better digestibility of protein and fiber, and those included in MICROBOND and LACTURE – a better fat digestibility.

The haematological parameters (Table 3) in all groups of calves fluctuated within the physiological range. The tendency towards a higher amount of haemoglobin in experimental calves suggested a higher intensity of vital processes comparing to those of the control group, confirmed by the better growth of these calves.

The blood of the experimental groups of calves contained on the average 6.3 g/L

Table 3. Morphological and biochemical indicators of blood in calves (n=15) treated via feed with probiotic preparations YEASTURE, MICROBOND and LACTURE (2 kg/tonne) from the 1st till the 6th month of age (experimental) and untreated (controls). Data are presented as mean ± SEM

Group	Hb g/l	Erythro-cytes T/L	Leuko-cytes, G/L	Total protein g/L	Immunoglobulins, g/L		
					Ig G	Ig M	Ig A
Experiment 1 − YEASTURE							
Control	127.4 ±10.13	7.22 ±0.19	8.8 ±0.11	57.6 ±1.11	13.0 ±0.65	1.94 ±0.18	0.39 ±0.04
Experimental	137.5 ±4.18	7.52 ±0.31	8.79 ±0.24	58.9 ±1.31	14.5 ±0.73	2.5 ±0.39	0.53* ±0.05
Experiment 2 − MICROBOND							
Control	132 ±3.60	5.94 ±0.18	9.25 ±0.13	60.9 ±1.41	13.6 ±0.32	1.87 ±0.29	0.37 ±0.08
Experimental	138.3 ±5.14	6.12 ±0.23	9.17 ±0.17	62.9 ±1.22	14.8* ±0.44	2.35 ±0.17	0.49 ±0.06
Experiment 3 − LACTURE							
Control	136.0 ±7.65	6.13 ±0.41	9.33 ±0.16	62.5 ±1.70	12.8 ±0.83	1.79 ±0.43	0.42 ±0.07
Experimental	138.6 ±6.43	6.24 ±0.27	9.13 ±0.15	65.3 ±4.72	14.4 ±0.94	2.4 ±0.51	0.55 ±0.08

*P<0.05 between groups in each experiment.

or by 4.8% more haemoglobin, and 0.2 T/L or by 3.1% more erythrocytes. This fact is an evidence for a higher intensity of vital processes in the experimental calves. The probiotic preparations had no effect on leukocyte counts and the total protein.

The results of blood investigation demonstrated that morphological parameters of blood corresponded to physiological standards (Kondrahin *et al.,* 1985). They were high enough and characterize good health status of calves.

The microorganisms of probiotics increased the level of different serum immunoglobulins. The amount of serum Ig G in experimental calves was on the average by 11.0% higher compared to that of controls and was significantly (P<0.05) different from controls in experiment 2. This could be explained as a reaction of the immune system to the antigens of microbial origin in the probiotic preparation. The amount of these form immunoglobulins in the blood from the experimental group of calves was by 29.4% higher vs the control group. It is known that the M forms of immunoglobulin are synthesized during the early stages of the immune response. The prompters of Ig M synthesis are the microorganisms of the digestive tract. (Spasskaja, 1998). The most considerable effect of probiotics YEASTURE, MICROBOND and LACTURE was observed on the level of Ig A average by 33.1% higher compared to the control group.

Table 4. The results of the control slaughter and meat quality in calves (n=10) treated via feed with probiotic preparations YEASTURE and MICROBOND (2 kg/tonne) from the 1st till the 6th month of age (experimental) and untreated (controls). Data are presented as mean ± SEM

Parameters	Experiment 1 - YEASTURE		Experiment 2 - MICROBOND	
	Control group	Experimental group	Control group	Experimental group
Live body weight , kg	167.0±5.84	178.0±7.11	176.0±6.03	179.0±5.81
Carcass output, %	52.82±0.87	53.93±0.68	53.12±0.52	53.61±0.48
Coefficient of succulence (tender parts/bones)	3.18±0.21	3.37±0.17	3.21±0.13	3.19±0.11
Chemical composition of meat, %				
Moisture content	73.91±0.82	72.83±0.46	74.12±0.85	71.96±0.77
Protein	20.53±0.28	21.04±0.19	20.13±0.21	20.07±0.20
Fat	4.69±0.43	5.21±0.52	4.83±0.31	6.05±0.42*
Physico-chemical properties of m. longissimus dorsi				
PH	5.46±0.09	5.42±0.46	5.43±0.04	5.51±0.05
Color, EK	128±9.60	132±16.13	127±14.05	151±17.20
Meat rigidity, kg/cm^2	2.45±0.27	1.92±0.13	2.38±0.18	1.76±0.24
Water holding capacity, %	57.53±2.72	59.87±1.68	56.41±2.80	62.27±1.63
Tryptophan, mg %	221.7±5.87	232.3±4.83	218.6±6.80	237.8±7.91
Oxyproline, mg %	80.31±2.85	79.14±1.60	80.67±2.30	78.63±1.69
Protein value (tryptophan/oxyproline)	2.76±0.12	2.93±0.13	2.71±0.17	3.02±0,14
Boiling loss, %	43.35±2.23	40.28±1.72	43.76±3.01	39.17±1.87

*P<0.05 between groups.

To summarize, probiotic preparations can be recognized as an additional measure for the introduction of antigens into the organism, which affects the specific protection system of the animal and cause an increase of various forms of immunoglobulins.

The results from the control slaughter and meat quality are presented in the Table 4. They demonstrate that the effect of probiotics YEASTURE and MICROBOND on carcass output and coefficient of succulence was insignificant. The tendency towards a lower humidity by 1.08 and 2.16% and higher amount of fat by 0.52 and 1.22% respectively was observed in the meat from the calves which were given probiotics. Probiotic preparations in ration tended to increase the softness of meat, protein value, water coherence (the latter increased by 2.34% and 5.86% respectively). Due to the great variation among the groups the results of physico-chemical properties of meat were not statistically reliable.

CONCLUSIONS

The probiotics YEASTURE, MICROBOND and LACTURE positively affected the growth rate of the calves. The addition of the preparations to the ground grain mixture for calves in ratio 2 kg/tonne,

increased the daily weight gain in experimental groups of calves by 8.9, 3.3 and 6% compared to the respective control groups.

The studied probiotic preparations improved the digestibility of nutrients. The digestibility of ration dry matter was higher by 0.95, 0.8 and 1.45%, of organic matter - by 0.85, 0.62 and 2.03%, of fat – by 0.55, 1.23 and 2.57%, of protein – by 1.86, 0.92 and 1.02%, of fiber – by 2.0, 0.8 and 1.3% – better in the experimental groups of calves than in controls for experiments 1, 2 and 3 respectively.

The probiotic preparations YEASTURE, MICROBOND and LACTURE had no negative impact on the physiological status of the calves. Morphological parameters of blood remained within the physiological range and indicated a good physiological status of the calves. Probiotic preparations enhanced the immune system.

The probiotic preparations YEASTURE and MICROBOND had no significant effect on the carcass output and the coefficient of succulence. The tendency towards a lower humidity by 1.08 and 2.16% and a higher amount of fat by 0.52 and 1.22% respectively was observed in the meat from calves which were given probiotics. The gustatory characteristics of meat improved.

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