Journal of Animal and Veterinary Advances 14 (10): 273-276, 2015
ISSN: 1680-5593

Unconventional Protein Sources for Calves

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Abstract: For normal growth and development of calves it is necessary to pay special attention to their feeding and balanced diets on essential amino acid. Amino acids needed by the body not only as a structural material, especially great is their role in the biosynthesis of numerous physiologically active compounds and structural compounds: nucleic acids, purine and pyrimidine bases, hormones, creatine, carnitine, vitamins and many others. Amino acids also perform the role of transport systems in the body and determine the activity of many enzymes. Thus, the search and synthesis of new sources of high quality protein feed with an optimal set of essential amino acids, mineral components and biologically active substances is an actual problem of modern science. The purpose of this study was to investigate the possibility of protefit usage in young cattle diets a new-feed additive, created from high quality food maize to identify the optimal nutritional intervention dose of protefit to determine its productive effect on body of animals in order to propose this supplement as a substitute for protein ingredients of the diet. Protefit nutritional interventionin the diets of calves instead of soy, pea and sunflower meal caused an optimization of an interstitial exchange which was accompanied by a high safety of livestock and a large increase in body weight. Protefit can be added into the diets of calves (20%) completely replacing other protein ingredients: soybean, pea, sunflower protein meal.

Key words: Protefit, proteins, essential amino acids, calves, feeding, diets

INTRODUCTION

Under the manufacturing livestock management in the diets of calves the use of pasture forages has dramatically decreased and the proportion of additives not peculiar to their body, increased which cause a sharp decrease in the composition of feed level of biologically active substances, necessary for normal growth and development of animals (Kirilov, 2006).

A significant impact on the growth and development of calves has been providing quality feed which is determined by the amount of proteins, fats and carbohydrates, their availability to animals as well as the presence and quantitative ratios in them of essential nutritional factors such as proteins, vitamins and mineral elements (Parshin *et al*., 2007).

Unbalanced diets on the individual biologically active substances reduces the genetically determined productivity of animals, reduce feed conversion ratio which affects the growth and reproductive capacity. The absence or lack of essential amino acids leads to disruption of protein metabolism that is characterized by negative nitrogen balance, cessation of regeneration proteins which is accompanied by pathological changes in the endocrine and enzyme systems (Merzlenko and Shumsky, 2004; Lushnikov, 2008).

Thus, the basic measure of prophylaxis of violation of animal protein diet is strict rationing of diets on the protein and amino acids including the addition in the diets of ruminant protein feed of plant (legumes, oil cakes, shorty, herbal flour from legumes) and animal (meat and bone and fish meal, dairy feed) origin.

However in the practice of feeding often does not consider the bioavailability of amino acids in various preparations (Noskov *et al*., 2014). Thus, there is a need to find new sources of protein for animals.

In our country and abroad various technologies that allow processing of non-food raw materials and protein to obtain the result of processing is highly active against biological agents have developed. Outstanding interest

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are preparations obtained by enzymatic hydrolysis of proteins and a mixture of low molecular weight peptides and amino acids-products with a high biological value. A number of hydrolytic amino-acid and peptide preparations obtained by hydrolysis of the blood of animals and birds, tissues of internal organs and muscles, collagen-containing raw materials, milk proteins, etc. was developed (Kirilov, 2006; Chabaev *et al*., 2000; Noskov *et al*., 2014).

Thus, the search and synthesis of new high-protein feeds with an optimal set of essential amino acids, mineral components and biologically active substances is an actual problem of modern science.

Given the above, scientists of Belgorod State Agricultural University and JSC of Petrochem developed a new protein-mineral supplement, called Protefit.

The purpose of our study was to investigate the possibility of protefit usage in young cattle diets a new feed additive, created from high quality food maize to identify the optimal nutritional intervention dose of protefit to determine its productive effect on body of animals in order to propose this supplement as a substitute for protein ingredients of the diet. To achieve the goal there are following objectives:

- To compare the growth rate of calves, kept on traditional diets and the diets which containprotefit
- To found the optimal nutritional intervention dose of protefit
- To identify morphological and biochemical changes in blood of animals, fed the diet with a new food additive

MATERIALS AND METHODS

Protefit produced by drying an aqueous solution obtained by soaking high quality food maize during the production of confectionery molasses. After 30-40 h excerpts of corn in the water in it becomes 70% minerals, 40-50% soluble carbohydrates, 16% soluble protein with the main part of dry substances of the extract consisting of dry matter of the embryo as he loses 85% mineral and 60% of proteins in the process of soaking. Heteroauxin (indole acetic acid) goes into corn-steep extract-indoleacetic acid (its content in dry matter up to 20 mg%).

Protefit contains a complex of amino acids, most of which are irreplaceable, fat and water-soluble vitamins, growth factors class heteroauxin and micro and macro elements that are contained in the form of salts of lactic acid or inozitfosfornah acids. This powder is light brown in color with a slight specific odor.

Composition: crude protein 30-43% phosphorus 2-3%, calcium 2-7%, magnesium 0.2-0.3%, potassium 0.35%, the exchange energy is 12.3 MJ kg^{-1}, heteroauxin 200-400 mg kg^{-1}.

Amino acid composition of protefit is represented by methionine, lysine, tryptophan, serine, proline, glycine, alanine, cystine, valine and other essential and nonessential amino acids.

The nature of protefit effects on the organism of calves was judged by clinical indicators, changes in protein, carbohydrate, mineral and vitamin metabolism, growth and productivity.

The formation of groups was carried out taking into account breed, age, live weight and health condition of birds. Blood for biochemical studies was taken from the jugular vein. Biochemical studies were performed by standard techniques using a biochemical analyzer.

Digital research material was subjected to mathematical treatment in the description by Planinskog (1987) the calculation of average arithmetic (M), their average error (m) and criterion validity (p). The differences were considered significant at $p < 0.05$.

RESULTS AND DISCUSSION

On the principle of analogues 4 groups of calves of simmental breed 60 day age of 20 animals each were formed to conduct research. The scheme of the experiment is shown in Table 1.

The first group of calves was the control and received a diet according to the sector scheme. The second group instead of the protein ingredients of the diet 10% of protefit were added, the third group instead of the protein ingredients of the diet 20% of protefit were added, the third group instead of the protein ingredients of the diet 30% of protefit were added. Drugs were applied for 20 days.

Conditions of keeping animals in control and experimental groups were identical. Micro-climate parameters during the whole experimental period were within the recommended modes. The results of drug trials are presented in Table 2.

Table 1: Scheme of the experiment on calves

Groups	Speciment (dose)
1: Control	The feed according to farm scheme (in the composition of the protein ingredients include soy 4%, peas 10%, sunflower meal 8%)
2: Experimental	In the feed instead of soy, pea and sunflower soybean meal was used 10% of protefit
3: Experimental	In the feed instead of soy, pea and sunflower soybean meal was used 20% of protefit
4: Experimental	In the feed instead of soy, pea and sunflower soybean meal was used 30% of protefit

Table 2: Results of protefit trials on calves

	Groups			
		Experimental		
Signatures	1 (control)	2	3	4
Quantity, animal in the beginning of the experiment	20.0	20.0	20.0	20.0
in the end of the experiment	20.0	20.0	20.0	20.0
Mortality	-	-	-	-
Livability (%)	100.0	100.0	100.0	100.0
Average daily gain (g)	998.7	1000.6	1125.6	1144.3

Table 3: Biochemical indicators of blood of calves

	Groups			
		Experimental		
Signatures	1 (control)	2	3	4
Basic data				
Calcium (mmol L^{-1})	2.33±0.30	2.36±0.310	2.38±0.34	2.40±0.28
Phosphorus (mmol L^{-1})	1.78±0.23	1.64±0.270	1.65±0.28	1.77±0.32
Cholesterol (mmol L^{-1})	1.40±0.23	1.54±0.220	1.57±0.17	1.40±0.33
Total left protein (g L^{-1})	57.80±0.63	9.50±0.525	9.40±0.68	58.70±0.78
Albumin (g L^{-1})	28.70±0.56	28.40±0.520	28.50±0.53	28.80±0.62
BUN (mmol L^{-1})	3.14±0.21	3.36±0.320	3.30±0.44	3.21±0.54
AST (u L^{-1})	78.46±1.33	76.28±1.490	76.31±1.40	77.11±1.23
ALT (u L^{-1})	26.52±1.50	28.39±1.670	28.31±1.65	27.29±1.77
After drugs usage				
Calcium (mmol L^{-1})	2.40±0.20	2.74±0.460	3.12±0.21*	3.16±0.32*
Phosphorus (mmol L^{-1})	1.80±0.20	1.83±0.220	1.90±0.26	1.88±0.24
Cholesterol (mmol L^{-1})	1.51±0.26	1.49±0.230	1.65±0.24	1.62±0.32
Total protein (g L^{-1})	58.10±0.67	59.80±0.840	62.30±0.82**	62.80±0.60**
Albumin (g L^{-1})	32.24±0.50	33.21±0.450	33.89±0.42	34.12±0.72
BUN (mmol L^{-1})	2.96±0.22	3.14±0.350	3.21±0.33	3.25±0.32
AST (u L)	112.40±3.16	110.70±2.980	98.40±2.88	99.10±3.21
ALT (u L^{-1})	36.21±1.54	34.25±1.670	30.22±1.60	29.86±1.69

*p<0.05; **p<0.01

Results presented in the Table 2 shows that average daily gains of calves of the second, third and fourth experimental groups exceeded control indices by 0.2, 12.7 and 14.6%. Calves in dietof which were added protefit, had higher feed conversion.

It should be noted that the higher gains and low feed costs had calves of the third and fourth experimental groups to the diets of which were added 20.0 and 30.0% of protefit, however, the optimal, most cost-effective dose ofnutritional intervention of protefit should be 20%.

Analysis of leukogram of animals showed that the studied feed additives did not cause any significant changes in the leukocyte populations of blood. Minor changes in the leukogram were statistically significant and were characterized by a tendency to increase the quantity of neutrophils. This indicates to the lack of immunogenic properties in protefit as well as alterimage action on the mucous membranes of the gastrointestinal tract or other tissues and organs of animals.

As to biochemical indicators of blood serum (Table 3) speciment effected on protein and mineral metabolism. Results presented in the table showed that at the end of the experimental period, after 20 days of application of protefit as a substitute for protein ingredients of animal feed, calves of the third and fourth experimental groups in serum protein takes placea significant increase of 7.3 and 8.1% and calcium 30.6 and 31.6%, compared to control in all cases $p<0.05$-0.01.

In the second experimental group where the proportion of protefit was 10%, neither at the protein nor calcium statistically significant difference from the control was not found and the observed increase in the concentration of these nutrients should be considered only a tendency of positive influence. Positive changes in phosphorus-calcium supply of the organism of calves can be associated with the fact that protefit contains calcium lactate which creates a balanced calcium-phosphorus complex with fitina phosphorus also presented in the drug.

At the end of the experimental period in the serum of animals of all experimental groups takes place an increase of albumin and a decrease in the activity of transamination enzymes but these changes had no statistically significant difference from the control.

Thus, the positive effect of the drug on the animal organism can be explained by the presence in protefit of

complex of biologically active substances, in particular, vitamins because it is likely that "surrounded by vitamins" metals form a bio-coordinational complexes, parts of which become more available for absorption in the blood and more active in metabolic processes. In the light of the foregoing, it is clear why in all the experimental groups, especially in the third and fourth where the dose of protefit in the diet was 20.0 and 30% growth of calves was faster. This probably also contributed to heteroauxin and unidentified in protefit factors. However, the optimal, most cost-effective dose of nutritional intervention of protefit should be 20%.

CONCLUSION

Taken results about more rapid growth of calves fed protefit, give reason to attribute it to nutritional product which combines two properties: the ability to stimulate the metabolic processes in the body and at the same time to satisfy growing needs in the plastic material for proteosynthesis (due to the contained free amino acids and protein).

Thus, on the basis of the conducted research it can be concluded that protefit is not only as good as the protein ingredients of the standard diet but also superior to them in bioavailability and growth promoting efficiency as well as in positive influence on metabolism.

Protefit can be added into the diets of calves (up to 20%) as a protein ingredient, completely replacing other protein components: soy, peas, sunflower meal.

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