EFFECTS OF PROTEASE SUPPLEMENTATION OF LOW PROTEIN BROILER DIETS ON GROWTH PARAMETERS AND CARCASS CHARACTERISTIC

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ABSTRACT

The experiment was conducted to evaluate the effect of addition of exogenous protease into broiler grower diets on growth parameters (body weight and feed conversion ratio) and carcass characteristic (carcass weight and yield). The used exogenous protease was enzyme a mono-component serine protease expressed in Bacillus licheniformis. For the in vivo studies, a heat stable formulated product containing 75,000 PROT/g was used. A total of 990 one-day-old ROSS 308 broiler chickens were randomly divided into 9 experimental units of 110 chickens per each and located randomly to 3 different experimental treatments. The experiment was realized between the 10^{th} and 35^{th} day of age. The basal diet was based on wheat, corn and soybean meal. The dietary treatments were a positive control diet (PC) contained a normal crude protein (CP) level (207 g CP per kg feed, 12.5 MJ/kg) and two low protein diets. The level of CP in the low protein diets (LP) was reduced by 4 % compare to PC. First LP diet (LP0) was without and second LP diet (LP1) was with the supplementation of 15,000 PROT PRO g feed. The results of the experiment showed that the exogenous mono-component protease added into low protein broiler diet had no significant effect on both observed growth parameters carcass characteristic.

Key words: broiler, protease, growth, carcass

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INTRODUCTION

In the last decades, it has been done a lot of research in the chicken nutrition about using the exogenous enzymes that could be beneficial (Campbell and Bedford, 1992; Leeson and Summers 2005; Seskevicience *et al.,* 1999) and many commercial enzyme products are currently available for the chicken nutrition. Phytases are already well established in chicken diets, and research is focusing more on the other enzymes. Protease is the on off the hot topic event that some previous studies reported that the wide range of endogenous proteases is synthesized and released in the gastrointestinal tract and these proteases are accounted to be sufficient to optimize feed protein utilization (Le Heurou-Luron *et al.,* 1993; Nir *et al.,* 1993). Despite of that, one applicable argument for using exogenous protease is using it in low protein diets. Enzyme supplementation should allow a reduction in CP level in fed whereas individually AA were not improved equally by supplementation and should be balanced (Zanella *et al.,* 1999). In recent years, proteases have grown in profile, there are currently several stand-alone proteases available, and new mechanisms of action have been proposed (Adeola and Cowieson; 2011). Exogenous serine protease enzymes enhancing protein and energy digestibility and thus improve the performance parameters (Fru-Nji *et al.,* 2011).

This objective of this study was to evaluate the effect of exogenous protease supplemented into broiler grower diets on growth parameters and carcass characteristic.

MATERIAL AND METHODS

The trial with broiler chickens was conducted in an environmentally controlled house in international station of poultry testing Ustrasice, Czech Republic. A total of 990 one-day-old ROSS 308 broiler chickens males and females were randomly divided into 9 experimental units of 110 chickens per each and located randomly to 3 different experimental treatments. The birds were kept under standard management conditions according to the ROSS 308 requirements and they consumed feed and water on an ad libitum basis. Light regime was followed: 1 to 7 d 23L:1D, 8 to 32 d 18L:6D, 33 to 35 d 23L:1D.

The used exogenous protease was enzyme claimed to be a purified mono-component serine protease is expressed in Bacillus licheniformis containing transcribed genes from Nocardiopsis prasina. For the in vivo studies, a heat stable formulated product containing 75,000 PROT/g was used.

Three dietary treatments based on wheat, corn and soybean meal were used with three replicates per each treatment. The first positive control diet (PC) contained a normal crude protein (CP) level (207 g CP per kg feed, 12.5 MJ/kg). The level of CP in the second and third diets (LP) was reduced by 4 % compare to PC to formulate lower protein diet (199 g CP per kg feed). This diet was fed without protease (PRO) supplementation to a second treatment (LP0) or with the supplementation of 15,000 PROT PRO per kg diet to a third treatment (LP1). The level PRO was added into LP1 treatment according to manufacture recommendation for grower diets. All diets were optimized to the same ME level (12.7 MJ/kg feed) and to the same nutrient content when only CP was differed. The composition of the experimental diets is shown in Table 1.

Diets were offered in 2 feeding phase, starter form 0 to 10th day and grower from 10th to 35th day, both in grout. Starter diet had for all treatment same composition (21,5 % CP; 12,2 MJ MEN/kg) and the experimental intervention was in grower diets. Chickens were individually weighed at 1, 10, 17, 24, 31 and 35 d of age. At the end of experiment 18 chickens per treatment were randomly selected for carcass characteristic.

Table 1. Composition of the diets (g/kg)

Ingredient	PC	LP0	LP1
Wheat	297.9	322.7	322.7
Maize	300.0	300.0	300.0
Soybean meal	281.2	259.8	259.8
Rapeseed meal	40.0	40.0	40.0
Soybean oil	44.2	40.5	40.5
Salt	2.15	2.14	2.14
Sodium sulphate	1.92	1.92	1.92
DL-Methionine	2.49	2.29	2.29
Lysine HCl	2.56	2.56	2.56
L-Threonine	0.75	0.70	0.70
Limestone	14.1	14.2	14.2
MCP	7.40	7.54	7.54
Phytase	0.90	0.90	0.90
Xylanase	0.50	0.50	0.50
Vitamin-mineral mix[1]	3.60	3.95	3.75
Protease (RPA)	**0.00**	**0.00**	**0.20**

1 Vitamin, mineral, and additive contibutions per kilogram of feed: Vit. A: 250 000 m.j. , Vit. D3: 40 000 m.j. ; Vit. E (alfa tokoferl): 700 mg; Vit. K3: 30 mg; Vit. B1: 30 mg; Vit. B2: 60 mg; Vit. B6: 25 mg; Vit. B12: 0,2 mg; Niacinamid: 210 mg; Cholin chloride: 6 200 mg; DL-methionin: 20 g; L-lysine: 14 g; Ca: 200 g; P: 48 g; Na: 15 g; Fe: 880 mg; Cu: 100 mg; Zn: 740 mg; Mn: 1 240 mg; Co: 4,5 mg; I: 5 mg; Se: 1,4 mg

The results were analyzed by STATISTICA CZ program using the single factor analysis of variation. Data were followed by Scheffe test.

RESULT AND DISCUSSION

The results of the average body weight and feed conversion ratio (FCR) per each treatment are shown in table 2. On the beginning of the experiment, the groups were arranged with minimum difference within them. In the first weighing at the age of 17 were found significantly higher average weight in the PC treatment compare to LP1 treatment. Since the 17th day off age, there were no significant differences ($P<0.05$) in body weight within the treatments during and on the end of the experimental period. Similar results has been published by Angel *et al.* (2011) in their study, when birds fed Low CP diets supplemented with protease (Bacillus Licheniformisat) at dose 200 mg/kg and more have the same growth performance results as birds fed Standard CP diets.

There have been observed any significant differences between the treatments in FCR. Although there was no significant difference between treatments, the final body weight was higher and FCR lower in groups fed diets without protease supplemented compare to Standard CP level diet (PC treatment). On the other hand, Fru-Nji *et al.* (2011) detected not significant, but partially improvements in FCR and higher weight gain in Low CP diets supplemented with exogenous protease compare normal CP level diet. Freitas *et al.* (2011) used the same protease as in our experiment and confirm improve FCR and digestibility of ME and CP, but no improvement in weight gain. Some other authors that used a protease from Aspergillus niger showed higher feed intake and weight gain (Ghazi *et al.* 2003; Ghazi *et al.* 2003). These improvements in growth performance parameters can be due to improve digestibility in ME and CP.

Table 2. Body weight (g) and feed conversion ratio in broilers

	Body weight						FCR
	10th day	17th day	24th day	31st day	35th day		g/kg
PC	206,8	586,8[a]	1027,3	1608,2	1832,0		1809,9
LP0	206,9	579,8[ab]	997,9	1568,6	1854,9		1800,7
LP1	207,2	574,7[b]	1005,7	1590,4	1878,2		1777,5

Different superscripts (a, b) indicate statistical significant difference between groups (P<0.05)

Table 3 shown the results of the carcass characteristic, carcass weight and yield in broiler in the experiment. There were no significant differences between the treatment on all observed carcass characteristic. Supplementation of exogenous protease had no significant effect on carcass weight and carcass yield in our experiment. Feeding broiler chickens Low CP diets with constant ME:CP ratio has adversely affected the growth performance, but carcass parameters unaffected without any increase in abdominal fat content (Kamran *et al.*, 2008).

Table 3. Carcass weight and yield in broilers

		PC	LP0	LP1
Live body weight	g	1901,7	1888,3	1909,4
Carcass weight	g	1270,4	1266,8	1273,4
Carcass yield	%	72,6	72,9	72,5

CONCLUSIONS

In conclusion, exogenous mono-component protease added into low protein broiler diet had no significant effect both on growth parameters, body weight and FCR, and no significant effect on both observed carcass characteristic, carcass weight and carcass yield.

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