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Original Paper

The effect of serine protease on broiler growth and carcass quality

Vojtěch Rada, Martina Lichovníková*, Marian Foltyn

Mendel University in Brno, Czech Republic

The experiment was performed to compare the influence of commercial serine protease in broiler grower diets with standard crude protein (CP) and lower CP level on growth parameters and carcass quality. One thousand three hundred twenty 1-d-old Ross 308 broiler chicks of both sexes were randomly allocated into 4 dietary treatments each with three replicates (4 × 3 × 110). Diets with two levels of CP (21.1 and 20.4%) with and without protease were used. At the end of the experiment 36 chickens from each treatment were randomly chosen for carcass quality measurement. Results of the experiment showed that supplement of serine protease to the diets did not have (P >0.05) significant effect on growth performance, but in lower CP diets improved both final body weight (1837.8 g vs. 1854.9 g) and feed conversion ratio (1800.7 g kg vs. 1785.2 g kg). The supplement of protease to the diet with lower CP had positive significant effect (P <0.05) on carcass yield (71.9 vs. 73.0 %). Serine protease supplementation had positive but not significant effect mainly on live weight and feed conversion ratio (FCR) in the diets with lower CP level.

Keywords: crude protein, chicken, carcass yield

1. Introduction

Monogastric animals lack the alloenzymes from rumen microflora and thus it become important to incorporate the exogenous enzymes in their diets to improve nutrient utilization from complex feed matric (Fru-Nji et al., 2011) and retarding the adverse effect of anti-nutritional factors present in the feed components (Ghazi et al., 2002; Munir, 2013). It is possible to improve the nutritional value of a diet for chickens through the use of exogenous enzymes (Cowieson and Ravindran, 2008). Using exogenous enzymes is more benefited at a younger age and that the contribution of the enzymes to nutrient retention decreased with age (Olukosi et al., 2007).

Chickens fed the Low CP diets containing protease grow as well as the chickens feed the Standard CP diets (Angel et al., 2011). Enzyme supplementation should allow a reduction in CP level in fed but Zanella et al. (1999) pointed out that individually amino acids were not improved equally by supplementation and should be balanced. 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 enhance protein and energy digestibility and thus improve the performance parameters (Fru-Nji et al., 2011). It is know that feeding broiler chickens Low CP diets unaffected carcass composition of broilers but increase carcass fat content (Si et al., 2001, Rezaei et al., 2004), hence it is possible to decrease carcass fat content by addition exogenous enzymes to the diets.

This study was designed to investigate the influence of serine protease supplementation in grower broiler diets with standard and lower CP level on live weight and carcass quality of chickens.

2. Material and methods

The experiment was conducted in an environmentally controlled house in international station of poultry testing Ustrasice, Czech Republic. A total of 1,320 one-day-old ROSS 308 broiler chickens males and females were randomly divided into 12 experimental units of 110 chickens each. The chickens were kept under standard management conditions. Light regime was followed: 1 to 7 d 23L:1D, 8 to 32 d 18L:6D, 33 to 35 d 23L:1D.

Feed and water were provided *ad libitum* throughout the experimental period. The fattening period was divided into 2 phases: starter (1 to 10 d) and grower (11 to 35 d) and the experiment was focused on own grower phase. Till the 10 days of age all chickens fed the same diets. Since 11 day of age there were fed four different diets; with standard content of CP (21.1 %) and lower content of CP (20.4 %) and always with or without protease supplement according to producer recommendation (0.2 g kg feed). Each treatment had three replications (4 × 3 × 110) dose with, while the other half was not supplemented.

*Correspodence: Martina Lichovníková, Mendel University in Brno, Faculty of Agronomy, Department of Animal Breeding, Zemědělská 1, Brno, 613 00, Czech Republic, e-mail: lichovmartina@gmail.com

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Table 1 Composition of experimental diets in g kg

	Standard CP		Lower CP	
Protease	-	+	-	+
Wheat	297.9	297.3	322.7	322.7
Corn	300.0	300.0	300.0	300.0
Soybean meal	281.2	282.3	259.8	259.8
Soybean oil	44.2	43.4	40.5	40.5
Rapeseed meal	40.0	40.0	40.0	40.0
Limestone	14.1	14.1	14.2	14.2
Monokalciumphosfate	7.4	7.4	7.5	7.5
Complex of minerals and vitamins	3.0	3.0	3.0	3.0
L-lysine HCl	2.6	2.6	2.6	2.6
DL-methionine	2.5	2.5	2.5	2.5
L-threonine	0.8	0.8	0.7	0.7
Salt	2.2	2.2	2.1	2.1
Sodium sulfate	1.9	1.9	1.9	1.9
Acid A mix WT-liquit	1.0	1.0	1.0	1.0
AG-Phytase	0.9	0.9	0.9	0.9
AG-Xylanase	0.5	0.5	0.5	0.5
protease	0.0	0.2	0.0	0.2
Nutrient composition in g kg				
CP	211.1	211.6	204.3	204.3
Fat	66.5	65.7	62.9	62.9
Lysine	13.0	13.1	12.5	12.5
Methionine	5.7	5.7	5.4	5.4
Threonine	8.6	8.6	8.2	8.2
Calcium	8.6	8.6	8.7	8.7
Phosphorus	5.6	5.6	5.6	5.6
Natrium	1.7	1.7	1.6	1.6

Composition of experimental diets is shown in Table 1. All chickens were individually weighed at 10, 17, 24, 31 and 35 d of age. At the end of experiment, 35 day of age, 18 chickens per treatment (9 males and 9 females) were randomly selected for carcass quality measurement.

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

3. Results and discussion

There were no significant differences (P <0.05) in final body weight, daily weight gain, and FCR among dietary treatments during experimental periods (Table 2). Although there was no significant difference between treatments, the final body weight, daily weight gain were higher and FCR was lower in group without supplemented protease in Standard CP level diets. On the other hand in Lower CP diets the final body weight and daily weight gain were higher and FCR was lower, when the diet was supplemented with protease. Our results are in agreement with study of Fru-Nji et al. (2011), who detected not significant, but partially improvements in weight gain and FCR in Low CP diets supplemented with protease RONOZYME® ProAct. But in the study of these authors the standard protein diet demonstrated a significant advantage over the Low CP diet. The same results also confirmed Angel et al. (2011) in their study, when chickens fed Low CP diets supplemented with protease (*Bacillus Licheniformisat*) at dose 200 mg kg^{-1} and more, had the same growth performance results as chickens fed Standard CP diets. Freitas et al. (2011) used the same protease as previous researchers and confirmed improvement of FCR and digestibility of ME and CP, but no improvement in weight gain. Addition of protease from *Aspergillus niger* improved feed intake and weight gain in stud of Ghazi et al. (2003) and Ghazi et al. (2002). The improvements in growth performance can be due to improvement of both digestibility in ME and CP.

The carcass quality (Table 3) was no significantly (P >0.05) influenced by addition of protease to the diet with Standard CP level. In Lower CP diets the addition of protease had significantly (P <0.05) positive effect on carcass yield. The abdominal fat content and share of abdominal fat in carcass were not affected by level of CP and protease supplementation (P >0.05). In similar study low CP diets with standard ME level caused increased body fat deposition (Aletor et al., 2000). In other study, feeding Low CP diets with constant ME:CP ratio had adverse effect on the growth performance, but carcass parameters were unaffected without any increase in abdominal fat content (Kamran et al., 2008). It can explain no difference in abdominal fat and share of abdominal fat between Standard CP and Lower CP diets supplemented with protease, because it should improve digestibility of nutrients and compensate ME : CP ratio.

Table 2 The effect of protease on broilers performance

	Protease	Body weight in g			Daily weight gain in g		FCR in g kg
		1	10	35	10 to 35	1 to 35	
Standard CP	-	41.3	206.8	1832.0	46.4	51.2	1808.1
	+	42.5	208.6	1818.8	46.0	50.8	1813.4
Lower CP	-	42.5	206.9	1837.8	46.6	51.3	1800.7
	+	41.0	206.9	1854.9	47.1	51.8	1785.2

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Table 3 The effect of protease on carcass quality

	Protease	Sex	Live body weight in g	Carcass weight in g	Abdominal fat in g	Share abdominal fat in %	Carcass yield in %
Standard CP	-	♂	2066	1380	6	0.3	72.5
		♀	1738	1161	7	0.4	72.7
		ø	1902	1270	7	0.3	72.6
	+	♂	2053	1379	8	0.4	72.7
		♀	1757	1172	6	0.3	72.5
		ø	1905	1276	7	0.4	72.6
Low CP	-	♂	2056	1373	9	0.4	72.4
		♀	1694	1106	8	0.5	71.3
		ø	1875	1239	9	0.5	71.9[a]
	+	♂	2040	1373	7	0.4	73.1
		♀	1737	1161	7	0.4	72.9
		ø	1888	1267	7	0.4	73.0[b]

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

In conclusion, results suggest that supplementation of exogenous protease had beneficial effect mainly in Lower CP diets (20.4 %), where no significant (P >0.05) improvement of live weight, weight gain and FCR were observed. Addition of protease had positive effect on (P <0.05) carcass yield at feeding diets with lower content of CP.

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