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EFFECT OF PROTEASE AND DURATION OF FATTENING PERIOD ON DRESSING PERCENTAGE OF BROILER CHICKENS

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Abstract: This study evaluates the effect of different crude protein levels in broiler diets supplemented with 0.2% and 0.3% protease enzyme (Ronozyme Pro Act) on dressed carcass weight and dressing percentage during two fattening periods (49 and 63 days). The fast-growing strain Cobb 500 was used. At the end of the fattening trial i.e. at 49 and 63 days, 10 male and 10 female birds were randomly sacrificed from each experimental group to determine body weights and conventionally dressed, ready-to-roast and ready-to-grill carcass weights. The data obtained were used to calculate the dressing percentages of the differently dressed carcasses. Results indicated that carcass weights and dressing percentages were not affected by diet ($P>0.05$), but also showed that the increase in the length of the fattening period by two weeks (from 7 to 9 weeks) led to increased carcass weights, while dressing percentages decreased ($P<0.05$).

Key word: broilers, protease enzyme, length of fattening period, dressing percentage.

Introduction

The production of poultry meat in the last decades has been characterised by the increasing use of new farming practices designed to improve farming conditions and reduce environmental pollution.

Broiler chickens require high protein levels in their feeds for optimum growth and feed conversion. The main protein-containing feed ingredients for broiler diets are soybean meal and full-fat soybean groats. Problems related to the GMO contamination of these feeds demand alternatives or replacement of these feeds with some other protein sources or reduction in the proportion of these feeds

in diets through improved protein utilisation by the use of different supplements *(Meluzzi et al., 2009)*.

Recently, numerous researchers (*Hajati et al., 2009; Fidelis et al., 2010; Angel et al., 2011; Frietas et al., 2011*) have examined the effect of protease supplementation along with the reduced use of plant-based protein feeds, primarily soybean meal, in broiler diets, whereas some other authors have studied carcass and meat quality traits in broilers as affected by the length of the fattening period (*Mitrović et al., 2004; Bogosavljević-Bošković et al., 2009; 2011a,b*).

The reason underlying the implementation of new broiler farming systems to replace the existing conventional method comes from legal regulations on poultry welfare such as EU directives (VO/EWG 1538/91 and VO/EG 1804/99) which prescribe minimum standards for non-commercial and organic poultry production (*Ristić, 2003*).

The objective of this study was to compare carcass weights and dressing percentages of differently dressed Cobb 500 broilers as affected by diet (standard broiler diets and diets containing lower levels of soybean meal and supplemented with protease enzyme) and length of fattening period (49 days and 63 days).

Materials and Methods

In the experiment, 300 day-old fast-growing Cobb 500 broilers were randomly assigned to three groups, each comprising 100 birds. Feed and water were provided ad libitum, and stocking density was 10 birds/m^2.

Dietary treatments

The feeding trial was conducted over a period of 63 days through starter (the first 3 weeks), grower (22-42 days) and finisher (42-63 days) stages. The following feeding treatments were used: control – C (feed formulation adapted to hybrid producer's recommendations), experimental group E-I (crude protein levels reduced by 4% than in the control diet, 0.2% protease supplementation) and experimental group E-II (crude protein levels reduced by 6% than in the C diet, 0.6 % protease supplementation). Complete feeds in mealy form were used. Feed formulations are given in Table 1.

Table 1. Feed ingredients of experimental diets for broiler chickens[1]

Ingredient, %	Starter stage (1 to 21 d)			Grower stage (22 to 42 d)			Finisher stage (43 to 63 d)		
Treatments	C	E-1	E-2	C	E-1	E-2	C	E-1	E-2
Maize	52.49	54.92	56.26	63.15	65.28	66.34	68.62	70.60	71.59
Soybean meal	22.24	19.79	18.44	13.00	10.85	9.78	9.10	7.10	6.10
Soybean groats	18.50	18.50	18.50	17.00	17.00	17.00	15.40	15.40	15.40
Feeding yeast	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
L-Lysine (78%)	0.10	0.10	0.10	0.20	0.20	0.20	0.23	0.23	0.23
DL-Methionine (99%)	0.22	0.22	0.22	0.30	0.30	0.30	0.30	0.30	0.30
Limestone	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10
Monocalcium phosphate	1.30	1.30	1.30	1.20	1.20	1.20	1.20	1.20	1.20
Salt	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35
Calcium formiate (30.5%)	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40
Captex T	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Premix[2]	1	1	1	1	1	1	1	1	1
Protease	0.00	0.20	0.30	0.00	0.20	0.30	0.00	0.20	0.30

[1] Treatments: C-control group, standard broiler diet, without protease; E-I- broilers fed a diet with a 4% reduction in crude protein level as compared to the control group, and 0.2% protease supplementation; E-II broilers fed a diet with a 6% reduction in crude protein level as compared to the control group, and 0.3% protease supplementation.

[2]Vitamin, mineral and additive contributions per kilogram of feed: vitamin A 14000IU; vitamin D_3 5250IU; vitamin E 83IU; vitamin B1 6.12mg; vitamin B_2 10.08mg; vitamin B_6 5.08mg; vitamin B_{12} 0.031mg; vitamin K_3 4.05mg; Ca-panthotenate 22.50mg; biotin 0.18mg; vitamin C 20.9mg; folic acid 2.04mg; niacin 85,5mg; choline chloride 600mg; Cu 28mg; Zn 100mg; Fe 48mg; Mn 100mg; Se 0.30mg, I 1mg; Co 0.30mg; antioxidant-BHT 0.12gr; coccidiostatic-Salinomycin (1 to 21day) 0.50gr; enzymes: phytase, xylanase, pectinase+β-glucanase

A protease preparation manufactured by DSM (The Netherlands) under the brand name Ronozyme ProAct (serine protease) was used for fattening at a proposed dose providing 15000 units of protease (PROT) kg^{-1} complete feed (i.e. 200 mg Ronozyme ProAct kg^{-1}). It is produced by fermentation of a sporulation-deficient Bacillus licheniformis strain which expresses a synthetic gene encoding a serine protease.

Data collection

At the end of the first experimental period i.e. at 49 days, 10 male and 10 female broilers were randomly selected from each group of birds. The same procedure was repeated at 63 days, when 10 males and 10 females were selected from among the remaining broilers. The selected chickens were individually weighed and, after slaughter, measurements of their conventionally dressed, ready-to-roast and ready-to-grill carcass weights were taken.

Statistical analysis

The data obtained were subjected to conventional statistical methods. The significance of differences for carcass quality parameters (weight at slaughter, dressed carcass weight, dressing percentage) was tested by analysis of variance i.e. in a two-factor 3x2 design (3 feeding treatments and 2 lengths of fattening period).

Carcass quality parameters were statistically evaluated using analysis of variance, F-test and Tukey's test, at a significance level of $P<0.05$ (*ANOVA, Microsoft STATISTICA Ver. 5.0, StatSoft Inc., 1995).*

Results and Discussion

Table 2. presents body weights at slaughter of broilers at different ages across experimental groups, and dressed carcass weights.

Table 2. Dressed carcass weights of broilers across experimental groups and lengths of fattening period

Treatment			Weight, gr			
Protease	Length of fattening period, days		at slaughter	conventionally dressed carcass	ready-to-roast carcass	ready-to-grill carcass
No	49	$\bar{x}$	3181.0[b]	2753.4[b]	2596.9[b]	2378.9[b]
		Sd	318.4	271.6	246.8	234.6
	63	$\bar{x}$	3999.5[a]	3439.1[a]	3221.5[a]	2931.3[a]
		Sd	501.4	405.2	374.4	363.4
0.2%	49	$\bar{x}$	3135.7[b]	2717.7[b]	2559.8[b]	2336.2[b]
		Sd	291.2	233.7	213.6	203.6
	63	$\bar{x}$	3986.0[a]	3415.6[a]	3201.6[a]	2929.2[a]
		Sd	498.1	407.9	383.9	363.9
0.3%	49	$\bar{x}$	3102.5[b]	2675.7[b]	2516.4[b]	2303.6[b]
		Sd	330.1	273.8	252.5	242.8
	63	$\bar{x}$	3892.0[a]	3326.0[a]	3111.7[a]	2834.8[a]
		Sd	418.1	327.5	295.2	282.5
p-value						
Source of variation						
Protease			0.573	0.412	0.353	0.388
Length of fattening period			0.001	0.001	0.001	0.001
Protease x length of fattening period			0.943	0.945	0.940	0.888

[a-b] Means within columns with different superscripts differ significantly ($P<0.05$)

As shown in Table 2, experimental chickens had similar body weights at the end of both fattening periods (49 or 63 days), with no significance (P>0.05) observed for the effect of experimental diets – complete feeds (with or without protease supplementation, with crude protein levels reduced). As the fattening period increased (from 49 to 63 days), live body weights of broilers expectedly increased and, hence, there was an increase in dressed carcass weights for different dressing methods (conventionally dressed, ready-to-roast and ready-to-grill (P<0.05).

Table 3. Dressing percentages of broilers across experimental groups and lengths of fattening period

Treatment			Dressing percentage, %		
Protease	Length of fattening period, days		conventionally dressed carcass	ready-to-roast carcass	ready-to-grill carcass
No	49	$\bar{x}$	86.57 ^{ab}	81.68 ^{a}	74.80 ^{a}
		Sd	0.91	1.08	0.91
	63	$\bar{x}$	86.08 ^{abc}	80.65 ^{ab}	73.32 ^{cd}
		Sd	1.31	1.71	1.44
0.2%	49	$\bar{x}$	86.73^{a}	81.71 ^{a}	74.55 ^{ab}
		Sd	1.04	1.37	1.43
	63	$\bar{x}$	85.75 ^{bc}	80.38 ^{b}	73.51 ^{bcd}
		Sd	1.03	1.41	1.41
0.3%	49	$\bar{x}$	86.28 ^{abc}	81.16 ^{ab}	74.26 ^{ab}
		Sd	0.86	1.03	0.84
	63	$\bar{x}$	85.54 ^{c}	80.06 ^{b}	72.90 ^{d}
		Sd	1.12	1.51	1.36
p-value					
Source of variation					
Protease			0.183	0.056	0.170
Length of fattening period			0.001	0.001	0.001
Protease x length of fattening period			0.598	0.930	0.723

$^{a-d}$ Means within columns with different superscripts differ significantly (P<0.05)

Similarly to dressed carcass weights, dressing percentages were not affected by diet (P>0.05). Consistently with the present results, some researchers (*Yadav and Sah, 2005)* found that dressing percentages in broilers at 48 days of age were not affected (P>0.05) by increasing protease levels and reducing crude protein concentrations. However, *Hajati et al. (2009)* observed that arabinoxylanase and β-glucanase enzyme supplementation led to an significant increase in the dressing percentage of 44-day-old broilers of the same strain (Cobb 500), with the range of values (78.10 to 80.10%) similar to those in the present study. In contrast, *Espino et al. (2000)* observed a slight increase in the dressing percentage of broilers fed diets

supplemented with protease, amylase and lipase. A slight increase in dressing percentage as induced by dietary enzyme supplementation was also reported by *Richter et al. (1991)* and *Osei and Oduro (2000)*, whereas *Hartman (1996)* obtained significantly higher values in broilers fed wheat-based diets supplemented with commercial enzymes.

The two-week prolongation of the fattening period resulted in an increase in dressed carcass weight and a concurrent decrease in dressing percentage ($P<0.05$). Dressing percentage was 85.54 - 86.73% for conventionally dressed carcass, 80.06 - 81.71% for ready-to-roast carcass, and 72.90 - 74.80% for ready-to-grill carcass. The present results on the effect of length of fattening period on dressing percentage are consistent with the findings of *Mello et al. (1996), Mitrović et al. (2004)* and *Bogosavljević-Bošković et al. (2009),* who also found that dressing percentages decreased with increasing length of fattening period. However, *Bogosavljević-Bošković et al. (2011a)* also reported a decrease in the dressing percentage of ready-to-grill carcass as the fattening period was increased from 7 to 9 weeks, but the decrease was not due to length of fattening period.

Conclusion

The results of this research indicate no differences in dressed carcass weights and dressing percentages between fast-growing Cobb 500 broilers fed complete feeds containing different crude protein levels (through reduced proportion of soybean meal in feeds) and supplemented with 0.2% and 0.3% protease (Ronozyme Pro Act), respectively ($P>0.05$). Moreover, carcass quality parameters were found to be significantly affected by the length of the fattening period, given that the prolongation of the fattening period from 49 to 63 days led to a significant increase in the weight of dressed carcass (conventionally dressed carcass, ready-to-roast carcass and ready-to-grill carcass) and a decrease in dressing percentage ($P<0.05$).

Uticaj enzima proteaze i dužine trajanja tova na randman klanja tovnih pilića

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Rezime

U radu su prikazani efekti različitih nivoa sirovih proteina u hrani za tovne piliće, uz dodatak enzima proteaze (Ronozyme Pro Act) u količini 0,2% i 0,3% na

masu i randmane obrađenih trupova pri različitom trajanju tova (49 i 63 dana). U ogledu je korišćen brzorastući tovni hibrid Cobb 500. Na kraju oglednih perioda, 49 i 63. dana, odabrano je slučajnim izborom po 10 muških i 10 ženskih pilića iz svake eksperimentalne grupe i izmerena je masa grla pre klanja, masa klasično obrađenog trupa, trupa spremno za pečenje i trupa spremno za roštilj. Na osnovu ovih podataka izračunat je randman različito obrađenih trupova pilića. Dobijeni rezultati ukazuju da mase i randmani trupova nisu bili pod uticajem ispitivanih obroka ($P>0,05$), ali i da su se sa produžavanjem trajanja tova za 2 nedelje (sa 7. na 9 nedelja) povećale mase trupova, uz istovremeno smanjivanje randmana obrađenih trupova ($P<0,05$).

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