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EFFECT OF DIETARY PROTEASE SUPPLEMENTATION ON CARCASS WEIGHT AND DRESSING PERCENTAGE OF BROILERS

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Original scientific paper

Abstract: This paper presents research results on the effect of protease supplementation of reduced crude protein broiler diet on carcass weight and dressing percentage of two broiler genotypes: fast-growing Cobb 500 and slow-growing Master Gris. Complete feeds for broilers in experimental groups E-I and E-II contained 4 and 6% less crude protein than the control (C), and were supplemented with protease (Ronozyme Pro Act) at a concentration of 0.2 and 0.3%, respectively. At 49 days of age i.e. at the end of the experiment, 10 male and 10 female broilers of both hybrids were randomly selected from each experimental group and slaughtered. Upon slaughter, conventionally dressed, ready-to-roast and ready-to-grill carcass weights and abdominal fat weight were measured. These data and body weight at slaughter were used to calculate dressing percentages and abdominal fat percentage. The results showed a significant effect of genotype and no effect of dietary treatments on carcass quality traits.

Key words: broilers, protease, dressing percentage, abdominal fat.

Introduction

Broiler meat quality is dependent on a large number of factors, primarily genotype and nutrition. Modern broiler hybrids, fed complete feeds containing all necessary nutrients, exhibit a very rapid growth rate, resulting in high amounts of meat produced over a relatively short period of time. As reported by *Leeson (2007)*, modern broiler hybrids are characterized by a very high growth rate and low feed conversion, while metabolic diseases, leg problems and increased fat deposition are common occurrences. One of the most important nutritional requirements for optimum animal performance is to provide adequate dietary protein levels (*Bregendahl et al., 2002*). Today, broiler feeds are mostly based on

soybean meal and full-fat soybean grits as primary protein feedstuffs, but due to GMO contamination problems, alternatives to these feedstuffs as protein sources have been increasingly investigated in recent studies *(Meluzzi et al., 2009)*.

Many researchers *(Fidelis et al., 2010; Angel et al., 2011; Frietas et al., 2011)* have studied the effect of protease supplementation of broiler diets containing reduced amounts of plant feedstuffs, primarily soybean.

The objective of this study was to evaluate whether reducing the amount of soybean meal in broiler diets supplemented with protease has an effect on carcass weight, dressing percentage, and abdominal fat weight and percentage in two broiler hybrids.

Materials and Methods

A total of 300 day-old Cobb 500 broilers were allocated to three groups-boxes each containing 100 birds. The slow-growing Master Gris hybrid included 300 day-old broilers assigned to three groups with 100 broilers. Stocking density was 10 birds/m^2. The broilers were randomly grouped, giving a random ratio of male to female birds across groups. The chicks had free access to water and feed, and a 24-hour photoschedule was applied. Ad libitum feeding was used.

A three-stage feeding program was used, including starter (0-21 days), grower (22-42 days) and finisher stages (42-49 days).

One group of broilers served as the control-C (fed normal nutrient levels, in accordance with broiler requirements during certain fattening stages), and the other two groups were experimental groups E-I and E-II (fed diets with crude protein levels reduced by 4% and 6% and supplemented with 0.2% and 0.3% protease, respectively). Feed ingredients (used across feeding stages and experimental groups) of diets are presented in Table 1.

A protease preparation commercially called Ronozyme ProAct (produced by DSM, The Netherlands) was used in the fattening trial.

Table 1. Ingredients of experimental diets for fattening 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	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.

On day 49 of the fattening trial, 10 male and 10 female broilers were randomly selected from each group, tagged, weighed and slaughtered after a fasting period of 10 hours.

At slaughter, conventionally dressed, ready-to-roast and ready-to-grill carcass weights and abdominal fat weight were determined and used to calculate dressing percentages and pre-slaughter abdominal fat percentage.

The data were subjected to conventional statistical methods. The significance of differences was tested by a two-factor analysis of variance using a 2x3 design (2 hybrids and 3 feeding treatments).

The significant differences determined by the analysis of variance and results of F-exp values were evaluated using Tukey's test. Significance was accepted at $P<0.05$. The tested parameters were subjected to an analysis of variance using ANOVA*, Microsoft STATISTICA Ver. 5.0, StatSoft Inc. (1995)*.

Results and Discussion

Table 2. presents conventionally dressed, ready-to-roast and ready-to-grill carcass weights and abdominal fat weight in broilers.

Table 2. Dressed carcass yield and abdominal fat weight of broilers (in g)

Hybrids	Groups		Pre-slaughter body weight	Conventionally dressed carcass weight	Ready-to-roast carcass weight	Ready-to-grill carcass weight	Abd. fat weight
Cobb 500	C (no protease)	$\bar{x}$	3181.0[a]	2753.4[a]	2596.9[a]	2378.9[a]	49.7[ab]
		Sd	318.4	271.6	246.8	234.6	12.7
	E-I (0.2% protease)	$\bar{x}$	3135.7[a]	2717.7[a]	2559.8[a]	2336.2[a]	53.6[a]
		Sd	291.2	233.9	213.6	203.6	15.4
	E-II (0.3% protease)	$\bar{x}$	3102.5[a]	2675.7[a]	2516.4[a]	2303.6[a]	48.7[ab]
		Sd	330.1	273.8	252.5	242.8	12.9
Master Gris	C (no protease)	$\bar{x}$	2570.2[b]	2200.5[b]	2056.0[b]	1834.6[b]	43.3[ab]
		Sd	192.7	165.9	151.4	136.8	13.5
	E-I (0.2% protease)	$\bar{x}$	2452.0[b]	2125.7[b]	1977.3[b]	1764.2[b]	40.8[b]
		Sd	210.2	184.1	163.2	148.0	11.4
	E-II (0.3% protease)	$\bar{x}$	2513.5[b]	2156.9[b]	2008.5[b]	1791.8[b]	46.1[ab]
		Sd	227.3	192.0	173.7	160.4	11.7
p-value							
Source of variation							
Hybrids			0.000	0.000	0.000	0.000	0.003
Protease			0.346	0.411	0.305	0.303	0.955
Hybrids x Protease			0.709	0.766	0.716	0.783	0.213

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

At the end of the experiment, the fast-growing hybrid had a higher body weight than the slow-growing hybrid ($P<0.05$), which consequently had an effect on dressed carcass weights (conventionally dressed, ready-to-roast and ready-to-grill carcasses). Cobb 500 broilers had a somewhat higher abdominal fat weight compared to Master Gris broilers, with significant genotype-related differences occurring only between E-I groups. The different diet formulations had no significant effect on final body weight in either hybrid, or on carcass yield and abdominal fat content ($P>0.05$).

Given the above-mentioned results, dressed carcass yield was largely dependent on body weight at slaughter i.e. the average dressed carcass weights were higher in broilers that had higher average body weights at slaughter.

Data on dressing percentage and pre-slaughter abdominal fat percentage across the factors analyzed (hybrids, dietary treatments) are given in Table 3.

Table 3. Dressing percentage and abdominal fat percentage (in %)

Hybrids	Groups		Dressing percentage for conventionally dressed carcass	Dressing percentage for ready-to-roast carcass	Dressing percentage for ready-to-grill carcass	% abd. fat
Cobb 500	C (no protease)	$\bar{x}$	86.6	81.7[a]	74.8[a]	1.57
		Sd	0.91	1.08	0.91	0.40
	E-I (0.2% protease)	$\bar{x}$	86.7	81.7[a]	74.5[a]	1.72
		Sd	1.04	1.37	1.43	0.50
	E-II (0.2% protease)	$\bar{x}$	86.3	81.2[a]	74.3[a]	1.58
		Sd	0.86	1.03	0.84	0.43
Master Gris	C (no protease)	$\bar{x}$	85.6	80.0[b]	71.4[b]	1.71
		Sd	1.95	1.14	1.04	0.58
	E-I (0.2% protease)	$\bar{x}$	86.7	80.7[ab]	72.0[b]	1.68
		Sd	1.20	1.35	1.55	0.50
	E-II (0.2% protease)	$\bar{x}$	85.8	79.9[b]	71.3[b]	1.86
		Sd	1.25	1.27	1.37	0.54
p-value						
Source of variation						
Hybrids			0.041	0.000	0.000	0.166
Protease			0.038	0.067	0.209	0.751
Hybrids x Protease			0.277	0.489	0.313	0.346

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

Table 3. shows that the broilers of both hybrids in all three experimental groups had a similar dressing percentage for conventionally dressed carcass and a similar abdominal fat percentage, with no differences as a result of tested factors observed (P>0.05). As regards the dressing percentage of ready-to-roast carcass, significance was found between C groups and E-II groups (P<0.05) (the fast-growing hybrid in these two groups had a higher dressing percentage compared to the slow-growing hybrid). Also, ready-to-grill carcass yield was higher in Cobb 500 than in Master Gris in all three groups (P<0.05), whereas no differences as a result of dietary treatments were observed (P>0.05).

Somewhat higher dressing percentages of Cobb 500 carcasses were obtained in this research compared to other studies *(Abudabos, 2010; Bogosavljević-Bošković et al., 2011; Nikolova et al., 2011)*. Master Gris broilers also had higher dressing percentages of conventionally dressed, ready-to-roast and ready-to-grill carcasses compared to those found for the same hybrid by *Blagojević et al. (2009)* at 91 days of age, *Škrbić et al. (2007)* for slow-growing Redbro broilers at 42 and 84 days of age, etc. The higher dressing percentages in this study are attributed to the higher

body weight of broilers at slaughter as well as to the longer duration of the grower stage (21 to 42 days) compared to other studies (grower stage up to 35 days).

The present results expectedly showed that fast-growing broilers had better dressing percentages compared to slow-growing birds, given their higher body weights and better body conformation scores. Similar results on better dressing percentages in fast-growing hybrids than in slow-growing broilers were obtained by *Grashorn and Clostermann (2002)* in their comparison between Ross strain (fast-growing hybrid) and ISA 657 genotype (slow-growing hybrid).

The feeding treatments (diet without protease and diets with crude protein levels reduced by 4 and 6 %, supplemented with 0.2 and 0.3% protease, respectively) had no effect on carcass quality parameters in broilers of either genotype, which is in compliance with the results reported by *Yadav and Sah (2005), Abudabos (2010)* and *Frietas et al. (2011)*.

Abdominal fat percentage relative to body weight at slaughter was quite lower than in Cobb 500 broilers at 49 days of age in *Café et al. (2002), Ahmadi and Karimov (2010),* and in *Hajati et al. (2009)* – at 44 days of age.

Conclusion

The results suggest that the tested carcass quality parameters (weights and dressing percentages of conventionally dressed, ready-to-roast and ready-to-grill carcasses, and abdominal fat weight and percentage relative to body weight at slaughter) were significantly affected by genotype (the fast-growing hybrid had higher values for these traits compared to the slow-growing genotype). Moreover, the modifications of diet formulations (E-I and E-II groups fed diets with crude protein levels reduced by 4% and 6% through the use of reduced amounts of soybean meal, and supplemented with 0.2% and 0.3% Ronozyme Pro Act protease, respectively) had no significant effect on the tested carcass quality parameters in either hybrid compared to broilers given standard diets (C groups).

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Efekti proteaze dodate u hranu na masu i randman trupova tovnih pilića

V. Dosković, S. Bogosavljević-Bošković, Z. Pavlovski, Z. Škrbić, S. Rakonjac, V. Petričević

Rezime

U radu su prikazani rezultati istraživanja dodavanja enzima proteaze u hranu za piliće u tovu, uz snižen nivo sirovih proteina, na masu i udeo različito obrađenih trupova pilića dva tovna hibrida: brzorastućeg hibrida-Cobb 500 i spororastućeg hibrida-Master Gris. Potpune smeše za piliće iz oglednih grupa O-I i O-II imale su za 4, odnosno za 6% manje sirovih proteina u odnosu na kontrolnu grupu (C), s tim da je u njih dodat enzim proteaza (Ronozyme Pro Act) u koncentraciji 0,2, odnosno 0,3%. Na kraju ogleda 49.dana, slučajnim izborom, odabrano je iz svake ogledne grupe od oba hibrida po 10 muških i ženskih grla za klanje. Nakon klanja izmerena je masa klasično-obrađenog trupa, trupa „spremno za pečenje", trupa „spremno za roštilj" i abdominalne masti. Na osnovu ovih podataka i mase pilića pre klanja izračunati su randmani trupova i udeo abdominalne masti.

Rezultati istraživanja pokazali su da su ispitivane osobine kvaliteta trupova pilića bile pod značajnim uticajem genotipa, a da nije bilo efekta različitih hrambenih tretmana.

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