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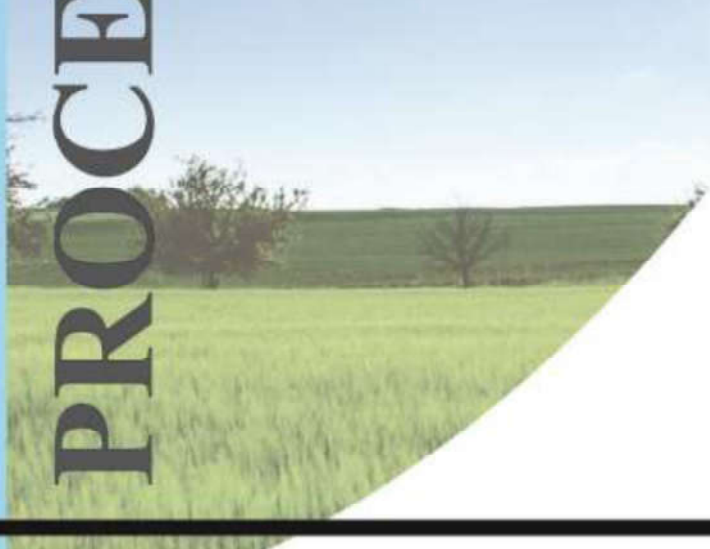

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EFFECT OF PROTEASE ADDED IN FOOD ON CHICKEN CARCASE QUALITY

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Abstract

This study evaluates the effect of protease-supplemented diets containing different crude protein levels and sex on the weight and percent yields of individual meat classes (class I meat: breast, drumsticks and thighs; class II meat: wings, and class III meat – back and pelvis) in Master Gris broilers (medium-growing strains). Chickens were fed maize-and-soybean-based diets. The fattening period lasted 49 days. Broilers were allocated to 3 dietary treatment groups: group C (standard diet, 0% protease), group E-I (0.2% protease, crude protein level reduced by 4% compared to C) and group E-II (0.3% protease, 6% reduction in crude protein compared to C). Results showed that no significant differences were observed in the weight of class I and class II meat between dietary treatments ($P>0.05$). Reduction of crude protein by 4% in diets supplemented with 0.2% protease affected the weight class III meat in male chickens ($P<0.05$). The feeding treatments did not influence the percentage of class I and class III ($P>0.05$), while significant differences were observed in percentage of class II meat (between male broilers in C and E-I groups, $P<0.05$). The effect of sex was significant on both weight and percentage of all three meat categories ($P<0.05$).

Keywords: *broilers, protease, sex, class meat.*

Introduction

Protein is the second major nutrient (after energy) and the most expensive in the broiler diet. The protein sources in modern poultry diets are mostly derived from soybean products.
The environmental impact from nitrogen and phosphorus that comes from undigested proteins and other excreted substances in the poultry manure (Gerber et al., 2015) has led to the idea of using supplemental exogenous enzymes like proteases in poultry diets.
Most commercial enzyme products currently available have more than one enzyme activity, whereas fewer products have only one substrate specificity. Enzyme blends are products having more than one enzyme and are either combinations of mono-component enzymes, generated by mixing enzymes targeting defined feed substrate matrixes, or fermentation products from wild-type strains of microorganisms expressing a broad spectrum of enzyme activities (Frietas et al., 2011).
Supplementation of the diet with enzymes which treat one or more of the factors limiting digestion enhances more complete protein digestion and more efficient growth (Kamel et al., 2015). Protease supplementation in diets for broilers improves the efficiency in utilizing vegetable and animal protein (Vieira et al., 2016) and improves protein digestibility and decreases synthesis of endogenous enzymes, resulting in higher availability of amino acids for protein deposition and minimizing protein waste (Kamel et al., 2015).
Many researchers (Dosković et al., 2017; Xu et al., 2017; Law et al., 2018) have studied the effect of protease supplementation of broiler diets on meat quality.
According to relatively rare research on non-industrial broiler hybrids, a medium hybrid Master Gris was selected for testing.

Thus, the objective of the present study was to evaluate the effect of reduction in the amounts of crude protein in corn and soybean meal-based diets and supplemented with protease enzyme on carcass characteristics (meat class) of medium-growing Master Gris chickens.

Materials and Methods

In the experiment, 300 day-old medium-growing Master Gris broilers were randomly assigned to three groups, each comprising 100 birds. Feed and water were available *ad libitum* throughout the experimental period. The experiment was performed in 2011.

Dietary treatments

The feeding trial was conducted over 49 days through starter (the first 3 weeks), grower (22-42 days) and finisher (42-49 days) stages. The following feeding treatments were used: control - C (control diet), experimental group E-I (crude protein levels reduced by 4% than in the control diet, 0.2% protease supplementation - Ronozyme ProAct) and experimental group E-II (crude protein levels reduced by 6% than in the C diet, 0.3 % protease supplementation - Ronozyme ProAct). Feed formulation was in powdered form. The diets were formulated based on corn and soybean products (Table 1).

Table 1. Composition of experimental diets for each rearing period chickens[1]

Ingredient, %	Starter stage (1 to 21 d)			Grower stage (22 to 42 d)			Finisher stage (43 to 49 d)		
Treatments	C	E-1	E-2	C	E-1	E-2	C	E-1	E-2
Corn	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
Calculated composition									
ME, kcal/kg	3.081	3.100	3.112	3.157	3.174	3.183	3.181	3.198	3.207
Crude proteins, %	22.59	21.72	21.24	18.99	18.22	17.84	17.16	16.45	16.09

[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.

Data collection

At the end of the experimental period i.e. at 49 days, a total of 12 male and 12 female broilers were randomly selected from each group of birds (3 male and 3 female broilers per replication). The selected chickens after slaughter, were dissected into primal cuts - breast, drumsticks, thighs, wings, back, pelvis (according to the Commission Regulation (EC) No. 543/2008) and meat class (class I meat: breast, drumsticks and thighs; class II meat: wings, and class III meat

- back and pelvis) were weighed. Based on the weights of meat class the proportions of meat class were determined.

Statistical analysis

The significance of differences for carcass quality parameters (weight and percent yields of individual meat classes) was tested by analysis of variance i.e. in a two-factor 3x2 design (3 feeding treatments and 2 sexes).

Meat class parameters were statistically evaluated using analysis of variance, F-test and LSD test (Stat Soft Inc Statistica For Windows. Version 7.0., 2006), at $P<0.05$.

Results and Discussion

Weight of individual meat classes are presented in Table 2.

Table 2. Weight of different classes of chicken meat in the dressed carcass on days 49, gr

Treatment			Class I (breast, thighs, drumsticks)	Class II (wings)	Class III (back, pelvis)
Groups	Sex				
C (no protease)	Male	$\bar{X}$	1182.74[a]	239.74[a]	465.77[a]
		Sd	46.79	7.75	21.51
	Female	$\bar{X}$	1028.83b	203.75[b]	402.47[c]
		Sd	43.90	4.77	17.61
E-I (0.2% protease)	Male	$\bar{X}$	1144.38[a]	237.31[a]	434.09[b]
		Sd	85.52	10.53	25.66
	Female	$\bar{X}$	991.26[b]	201.02[b]	385.91[c]
		Sd	33.31	6.05	15.37
E-II (0.3% protease)	Male	$\bar{X}$	1155.44[a]	239.37[a]	452.29[ab]
		Sd	61.94	10.17	29.09
	Female	$\bar{X}$	1000.20[b]	199.00[b]	391.92[c]
		Sd	66.69	12.16	28.98
p-value					
Source of variation					
Protease			0.117	0.581	0.008
Sex			0.001	0.001	0.001
Protease x sex			0.998	0.690	0.566

$\bar{X}$ -Average, Sd - Standard deviation

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

Analysis of the data in Table 2. showed that no significant differences were observed in the weight of class I and class II meat between dietary treatments ($P>0.05$), but there were differences in the class III meat weight. Namely, control males had higher weight class III meat compared to E-I male broilers ($P<0.05$). Also, the data in Table 2 showed a significant effect of broiler sex on the weight of the all three meat categories ($P<0.05$), because male chickens had a higher mass of all three classes of meat compared to female chickens, which was due primarily to lower body weight at slaughter. Similarly, some other authors (Blagojević et al., 2009; Dosković et al., 2016) have reported for the effect of broiler sex on some parameters of carcass quality, regardless of age.

Table 3. The percentage of different classes of chicken meat in the dressed carcass on days 49, %

Treatment			Class I (breast, thighs, drumsticks)	Class II (wings)	Class III (back, pelvis)
Groups	Sex				
C (no protease)	Male	$\bar{X}$	60.50^{ab}	12.27^{b}	23.82
		Sd	0.70	0.43	0.42
	Female	$\bar{X}$	60.00^{b}	11.89^{c}	23.48
		Sd	1.36	0.39	0.85
E-I (0.2% protease)	Male	$\bar{X}$	60.91^{a}	12.65^{a}	23.13
		Sd	1.02	0.32	0.72
	Female	$\bar{X}$	60.06^{ab}	12.18^{bc}	23.38
		Sd	0.77	0.37	0.68
E-II (0.3% protease)	Male	$\bar{X}$	60.40^{ab}	12.52^{ab}	23.64
		Sd	1.17	0.29	0.82
	Female	$\bar{X}$	59.88^{b}	11.92^{c}	23.46
		Sd	0.77	0.47	0.77
p-value					
Source of variation					
Protease			0.528	0.026	0.220
Sex			0.018	0.001	0.632
Protease x sex			0.827	0.676	0.415

$\bar{X}$ - Average, Sd - Standard deviation

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

Carcase characteristics assay - percent yields of individual meat classes (Table 3) demonstrated that different diet formulations used for the experimental groups of broilers had a considerably lower effect on the all class meat. Namely, that only dietary treatments had a significant effect (P<0.05) on the percentage yield of class II meat (control males had lower percent yields of class III meat compared to E-I male broilers), whereas that of class I and III meat was not significantly affected by this factor (P>0.05). The results in table 3. suggested that male birds had a significantly higher percent yields of class II meat (wings) compared to female birds (P<0.05). The percent yield of class I and III meat was not affected by sex (P>0.05).

Mohammadigheisar and Kim (2018) reported that carcase characteristics were not affected by the addition of exogenous protease to the diet of broiler chickens. Also, Dessimoni et al. (2019) determined that there were no effects on carcass and breast yield of male Cobb 500 in fattening that lasted 42 days when the contents of digestible amino acids were reduced (lysine, methionine, and threonine) with the addition of protease.

Bogosavljevic-Bošković et al. (2011) reported that no significant differences were observed in the percentage of class I, class II and class III meat between the sexes of broilers (P>0.05) for the Hybro broilers, while Young et al. (2001) states that there is no difference between percentage of wings - class II meat.

Conclusion

The results showed that the no significant differences were observed in the weight of class I and class II meat between dietary treatments (P>0.05), as well as that the reduction of crude protein by 4% in diets supplemented with 0.2% protease affected the weight class III meat in male chickens (P<0.05). The feeding treatments did not affect percentage of class I and class III (P>0.05), while significant differences were observed in percentage of class II meat (between male broilers in C and E-I groups, P<0.05). The effect of sex was significant on both weight and percentage of all three meat categories (P<0.05).

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