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EFFECTS OF GENOTYPE AND PROTEASE ENZYME SUPPLEMENTATION ON THE PRIMAL CARCASS CUTS OF CHICKENS

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Abstract: This study compared weight and percent yields of primal carcass cuts of commercial fast-growing broiler - Cobb 500 and medium-growing broiler genotype - Master Gris. Three hundred Cobb 500 chickens and three hundred Master Gris chickens were used for the experiment. Feed and water were provided *ad-libitum.* Treatments were: T1 - corn-soybean meal based control diet; T2: T1 − 4.0% crude protein than in the control diet + 0.2% protease and T3: T1 − 6.0% crude protein than in the control diet + 0.3% protease. Chickens were slaughtered at 49 days of age. Medium-growing hybrid Master Gris had a lower weight of all primal carcass cuts and breast yield (as a percentage of ready-to-grill carcass weight), as well as higher thighs, drumsticks, wings and pelvis yields in comparison with the Cobb 500 broilers ($P<0.05$), except back yield ($P>0.05$). Also, the addition of protease to broiler feed had no significant effect on the weight and percent yields of primal carcass cuts ($P>0.05$).

Keywords: hybrids, broilers, protease enzyme, primal carcass cuts

Introduction

In the production of chicken meat in recent decades, increasing attention is paid to minimizing the cost of broiler fattening and reducing the environmental pollution. Several factors such as genotype, diet composition, digestible nutrient content, energy to protein ratio, feed form, feed processing, environment, and disease could affect the cost of production and poultry product quality through influencing feed intake, body weight gain and feed conversion ratio (*Ahiwe et al., 2018*).

Today, technologies supplemented by exogenous enzymes (xilanase, phytase, glucanase, protease, amylase,…) in the corn-soybean based diet are most commonly used to achieve these goals. Aiming to increase the efficiency of rations, the usage of exogenous enzymes in the feeding of broilers is gaining more space and has become a great alternative, since it enhances food digestibility, minimizing the anti-nutritional effects and promoting the productivity indexes (*Hooge et al., 2010*). These enzymes can be included in the diet of livestock to improve digestibility, reduce nitrogen and phosphorus pollution, reduce diet cost, and improve the uniformity of animal growth (*Cowieson et al., 2019*).

Proteases may have an 'extra-proteinaceous' advantage for broilers reared under high-temperature conditions by improving gut health (*Cowieson et al., 2016*). Single exogenous protease, when added to the diet, effectively increased the apparent amino acid and protein digestibility in the broiler chicken's diet, even in a low protein diet (*Romero et al., 2014; Law et al., 2015; Bertechini et al., 2020; Da Silva et al., 2021,…*). Some researchers (*Sabino et al., 2004; Kamran et al., 2008;…*) have examined the effects of reducing the levels of crude protein in the diet with exogenous enzyme supplementation on carcass yields and cuts of chickens.

The objective of this study was to compare the carcass characteristics and meat quality of a medium-growing broiler - Master Gris with a fast-growing commercial Cobb 500 broiler, both grown in identical housing conditions and fed the same diet (a diet based on maize and soybean meal, with or without protease enzymes).

Materials and Methods

A total of 300 Cobb 500 broiler chickens (1 day old, 44.73 g weight) and 300 Master Gris chickens (1 day old, 43.03 g weight) were used in the experiment. Diets were provided in phases: starter (day 1-21), grower (day 22-35) and finisher (day 35-49). Respective diets (mash feed) and water were provided *ad libitum* from day 1 to 49.

Diet treatments were T1: control diet (based on maize and soybean meal, starter phase 22% crude protein, grower phase 19% crude protein, finisher phase 17% crude protein), T2: T1 − 4.0% crude protein than in the control diet + 0.2% protease and T3: T1 − 6.0% crude protein than in the control diet + 0.3% protease. The enzyme preparation used in this study was a commercial product (Ronozyme ProAct®, produced by DSM, The Netherlands) produced through submerged fermentation of Bacillus licheniformis.

At the end of the experimental period (day 49), a total of 20 birds (10 male and 10 female) were randomly selected from each treatment. Chickens were weighed and slaughtered and then the ready-to-grill carcass weight. After that, the carcasses are cut into primal cuts - breast, drumsticks, thighs, wings, back, pelvis and abdominal fat. Primal cuts is the measured weights and the proportions of primal cuts in relation to the ready-to-grill carcass weight were calculated.

Statistical analysis data were subjected to two-way factorial ANOVA (hybrids, diet treatments). The significance of differences between means was determined by the LSD test and differences were considered significant at $P<0.05$. Statistical analyses were performed using the Stat Soft Inc Statistica For Windows, Version 7.0., 2006.

Results and Discussion

Table 1 presents weight of primal carcass cuts - breast, drumsticks, thighs, wings, back and pelvis in broilers two hybrids.

Table 1. Effect of hybrids and diet on weights of primal carcass cuts across treatments, g

Hybrid	Diet		Breast	Drumsticks	Thighs	Wings	Back	Pelvis
Cobb 500	T1	$\bar{x}$	798.68[a]	326.45[a]	376.97[a]	261.88[a]	283.53[a]	246.21[a]
		Sd	80.28	43.93	43.89	27.22	33.25	31.64
	T2	$\bar{x}$	791.36[a]	312.57[a]	372.29[a]	252.15[a]	274.78[a]	244.96[a]
		Sd	91.38	34.71	37.13	27.11	51.96	30.86
	T3	$\bar{x}$	764.78[a]	307.96[a]	361.19[a]	253.83[a]	279.95[a]	252.22[a]
		Sd	88.92	40.65	39.29	30.17	34.80	41.06
Master Gris	T1	$\bar{x}$	524.51[b]	277.48[b]	303.78[b]	221.74[b]	222.64[b]	211.47[b]
		Sd	38.66	28.44	31.98	19.49	27.09	16.44
	T2	$\bar{x}$	509.90[b]	264.66[b]	293.25[b]	219.16[b]	209.10[b]	200.89[b]
		Sd	48.88	32.09	26.78	20.41	19.00	18.15
	T3	$\bar{x}$	515.70[b]	265.04[b]	297.08[b]	219.18[b]	216.55[b]	205.55[b]
		Sd	50.58	31.26	28.49	23.41	24.80	22.06
p-value								
Source of variation								
Hybrid			0.000	0.000	0.000	0.000	0.000	0.000
Diet			0.394	0.113	0.347	0.491	0.332	0.552
Hybrid x Diet			0.554	0.921	0.633	0.799	0.950	0.608

$\bar{X}$ -Average, Sd - Standard deviation
a-b Means followed by different superscript letters within columns differ significantly ($P<0.05$)

The results presented in Table 1 showed a significant effect of genotype, ie hybrid on the weight of primal carcass cuts in chickens ($P<0.05$). Average weight of primary cuts were higher in broilers Cobb 500, which was expected, according to a higher body mass chickens of hybrids at the end of the experiment. Also, the results of the experiment show that lowering crude proteins levels, with the addition of protease enzymes, did not have a negative effect on examined carcass characteristics (P>0.05). The breast weight of fast-growing broilers (784.94 g) was 1.52 time higher compared to the breast weight (516.70 g) of medium-growth hybrids. *Aksoy et al. (2010)* also reported fast-growing genotypes showed higher breast, legs, wings, back and neck weight than medium growing birds (P<0.001). Commercial fast-growing chickens had higher live weight, carcass, breast and thigh-drumstick weights (P<0.05) compared to medium and slow-growing chickens (*Cömert et al., 2016*).

Data on percent yields of primal carcass cuts (breast, drumsticks, thighs, wings, back and pelvis) the factors analyzed (hybrids, dietary treatments) are given in Table 2.

Table 2. Effect of hybrids and diet on percentage yield of primal carcass cuts of broilers, %

Hybrid	Diet		Breast	Drumsticks	Thighs	Wings	Back	Pelvis
Cobb 500	T1	$\bar{x}$	33.60^{a}	13.69^{b}	15.83^{b}	11.02^{b}	11.92	10.34^{c}
		Sd	1.59	0.87	0.68	0.53	0.80	0.70
	T2	$\bar{x}$	33.93^{a}	13.38^{b}	15.96^{b}	10.79^{b}	11.68	10.47^{bc}
		Sd	3.59	0.90	1.17	0.65	1.46	0.76
	T3	$\bar{x}$	33.24^{a}	13.34^{b}	15.47^{b}	11.02^{b}	12.15	10.91^{b}
		Sd	2.29	0.67	1.19	0.62	0.66	0.96
Master Gris	T1	$\bar{x}$	28.62^{b}	15.10^{a}	16.53^{a}	12.08^{a}	12.11	11.54^{a}
		Sd	1.33	0.56	0.75	0.44	0.88	0.56
	T2	$\bar{x}$	28.90^{b}	14.97^{a}	16.62^{a}	12.42^{a}	11.86	11.40^{a}
		Sd	1.20	0.79	0.45	0.41	0.60	0.68
	T3	$\bar{x}$	28.78^{b}	14.77^{a}	16.58^{a}	12.22^{a}	12.08	11.47^{a}
		Sd	1.25	0.848	0.58	0.49	0.81	0.58
p-value								
Source of variation								
Hybrid			0.000	0.000	0.000	0.000	0.549	0.000
Diet			0.659	0.148	0.388	0.819	0.228	0.195
Hybrid x Diet			0.785	0.845	0.431	0.099	0.782	0.134

$\bar{X}$ -Average, Sd - Standard deviation
a-b Means followed by different superscript letters within columns differ significantly (P<0.05)

The results presented in Table 1 showed that chickens of the fast-growing hybrid had a higher percent yields of breasts, and a lower percent yields of drumsticks, thighs, wings and pelvis compared to the medium-growing genotype (P<0.05), with a similar percent yields of backs (P>0.05). Nutritive applied treatments did not affect the percentage yield of the primary carcass cuts, in addition to the percent yield of the pelvis in the genotype Cobb 500 (significant differences were observed between the groups T1 and T3, $P<0.05$).

Relative weights of parts to cold carcass weight fast-growing genotypes showed a higher average for breast only whereas medium-growing genotypes had higher values for other parts (*Aksoy et al., 2010*). A similar difference in carcass traits between fast- and medium-growing genotypes was also found *Santos et al. (2004), Fanatico et al. (2008)* and *Dal Bosco et al. (2014)*. Higher relative breast weight in fast-growing broiler in comparison with slow-growing broiler were also cited by *Nielsen et al. (2003), Fanatico et al. (2005)* and *Jaspal et al. (2020). Cömert et al. (2016)* published that the effect of the genotype was important for the breast and thigh-drumstick yields ($P<0.05$), fast-growing hybrids had higher breast yield, whereas medium slow-growing chickens had higher thigh-drumstick yield ($P<0.05$).

Conclusion

Based on the findings of the present study, it may be concluded that the differences in weight and percent yields of primal carcass cuts between the two hybrids of different intensity of growth were significant, except for the share of the back. Namely, the weights of all primal carcass cuts and breast yield were greater in fast-growth broilers, while the percent yield of drumsticks, thighs, wings and pelvis were greater in medium growth broilers. Also, present results showed that it was possible to reduce crude protein level without any negative effect on the weight and percent yields of primal carcass cuts of commercial fast-growing broiler (Cobb 500) and medium-growing broiler genotype (Master Gris) by adding protease to the diet of broiler chickens.

Uticaj genotipa i dodatka enzima proteaze na karakteristike trupa pilića

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Rezime

U radu je upoređena masa i udeo osnovnih delova trupa komercijalnog brzorastućeg hibrida pilića - Cobb 500 i srednje rastućeg linijskog hibrida - Master Gris. U ogledu je bilo tri stotine pilića Cobb 500 i tri stotine pilića Master Gris. Ishrana i napajanje su bili po volji. Tretmani ishrane su bili: T1 - kontrolni obrok na bazi kukuruza i sojine sačme; T2: T1 − 4,0% sirovih proteina u odnosu na kontrolni obrok + 0,2% proteaze i T3: T1 − 6,0% sirovih proteina u odnosu na kontrolni obrok + 0,3% proteaze. Klanje pilića obavljeno je u uzrastu od 49 dana. Medium-growing hibrid Master Gris je imao manju masu svih osnovnih delova trupa i udeo grudi (u odnosu na masu trupa "spremno za roštilj"), kao i veći udeo bataka, karabataka, krila i karlice u poređenju sa pilićima Cobb 500 (P<0.05), izuzev udela leđa (P>0.05). Takođe, dodatak proteaze u hranu za piliće nije imao značajan uticaj na masu i udeo osnovnih delova trupa (P>0.05).

Ključne reči: hibridi, brojleri, enzim proteaza, osnovni delovi trupa.

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