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EFFECT OF PROTEASE AND SEX ON CARCASS QUALITY AND ABDOMINAL FAT OF SLOW-GROWING HYBRID OF CHICKEN

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Abstract

The paper presents slaughter indicators, including carcass weights, abdominal fat weight, dressing percentages, and abdominal fat percentage, in slow-growing hybrid Master Gris chickens, depending on the content of crude protein (with or without added protease enzyme) in the diet and the sex of the chickens. The trial lasted 49 days. Three hundred one-day-old chickens were divided into three experimental groups: control - C (starter stage 22% crude protein in feed, grower stage 19% crude protein in feed and finisher stage 17% crude protein in feed), experimental group E-I (crude protein levels reduced by 4% than in the control diet, with the addition of 0.2% protease enzyme - Ronozyme Pro Act) and experimental group E-II (crude protein levels reduced by 6% than in the C diet, with the addition of 0.3% protease enzyme - Ronozyme Pro Act). At the end of the experiment, 10 male and 10 female chickens were randomly selected from each experimental group. After being individually measured, they were slaughtered. Then 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. Results indicated that on carcass quality traits dietary treatments ($P>0.05$), had no effect except live weight, where differences appeared between females C and E-I group ($P<0.05$). The influence of sex on the examined traits was much greater, as significance was manifested in live weights, all masses of processed carcasses and abdominal fat, as well as dressing percentage for ready-to-roast carcass and abdominal fat percentage ($P<0.05$).

Keywords: *chickens, slow-growing hybrid, carcass weights and percentages, abdominal fat.*

Introduction

Broiler chickens have high needs for all nutrients for intensive growth. This also determines the high cost of broiler feed, and thus the cost-effectiveness of production. Therefore, alternative diets for poultry are being researched. One of the solutions that is often proposed is to reduce the content of some nutrients with the use of feed additives that will improve their digestibility. Potential profits of low-protein diets include reducing the cost of feeding, nitrogen emissions from livestock production, and environmental impact (Attia et al., 2020), which were advantageous in enhancing survivability (Amer et al., 2021). Enzymes (phytase, protease, and other enzyme combinations) are used to enhance nutrient maintenance in growing chickens. The efficacy of enzyme addition can be affected by various variables, including feed composition, avian age, environmental conditions, enzyme type and dosage, and interactions with other feed additives (Radhi et al., 2023). Also, protease improves the utilization of energy from food (Qiu et al., 2023), an increase in nitrogen digestion in a main protein-based ration (Cowieson et al., 2017), increases the growth rate of broilers (Lee et al., 2023), and reduce uric acid levels in manure (Rodríguez-Soriano et al., 2025). In studies of protease enzymes in

broilers, emphasis is most often placed on production results and digestibility of nutrients, while there is much less data on its influence on slaughter indicators and meat quality. Based on the above considerations, this study was conducted to evaluate the effects of exogenous protease (0.2 or 0.3%) in diets and sex of slow-growing hybrid Master Gris chickens on some carcass quality parameters (carcass weights, abdominal fat weight, dressing percentages and abdominal fat percentage).

Materials and methods

A total of 300 one-day-old chickens of slow-growing hybrid Master Gris were divided into three experimental groups ((100 birds/group): control - C (starter stage 22% crude protein in feed, grower stage 19% crude protein in feed and finisher stage 17% crude protein in feed), experimental group E-I (crude protein levels reduced by 4% than in the control diet, with the addition of 0.2% protease enzyme - Ronozyme Pro Act) and experimental group E-II (crude protein levels reduced by 6% than in the C diet, with the addition of 0.3% protease enzyme - Ronozyme Pro Act). The experiment period was divided into 3 phases: the starter phase (0-7 d of age), the grower phase (8-21 d of age), and the finishing phase (22-49 d of age). The experimental diets were based on corn-soybean meal and fed in mash form. Feed and water were provided *ad libitum* throughout the experimental period. The photoperiod was set at continuous light (24 L). The protease utilized was a commercial thermostable and granulated product (Ronozyme ProAct) which contains 75 000 protease units per g, produced by submerged fermentation of *Bacillus licheniformis*. At the end of the experiment, 10 male and 10 female chickens were randomly selected from each experimental group. After being individually measured, they were slaughtered. Then conventionally dressed, ready-to-roast and ready-to-grill carcass weights and abdominal fat weight were measured. Conventionally dressed carcass contains carcass with head and neck, lower legs and edible internal organs; ready-to-roast carcass contains carcass with lungs and kidneys or without lungs and kidneys, with neck with or without skin, heart, liver, stomach and spleen and ready-to-grill carcass contains carcass with lungs and kidneys or without lungs and kidneys and without liver, heart, spleen, stomach and neck. These data and body weight at slaughter were used to calculate dressing percentages and abdominal fat percentage.

The results were analyzed by Stat Soft Inc Statistica For Windows (Version 7.0., 2006) program. Two-factor (protease doses and sex) analysis of variance and LSD test at 5% probability was performed for mean comparison when significant interactions were observed.

Results and discussion

The results for the weights of conventionally dressed, ready-to-roast and ready-to-grill carcass and abdominal fat weight are shown in Table 1.

Table 1. Dressed carcass yield and abdominal fat weight of broilers (in g)

Groups	Sex		Pre-slaughter body weight	Conventionally dressed carcass weight	Ready-to-roast carcass weight	Ready-to-grill carcass weight	Abd. fat weight
C (no protease)	♂	$\bar{x}$	2743.50^{a}	2347.59^{a}	2188.93^{a}	1954.75^{a}	38.69^{bc}
		Sd	71.10	78.52	75.24	69.55	13.45
	♀	$\bar{x}$	2397.00^{b}	2053.48^{b}	1923.18^{b}	1714.44^{b}	48.00^{ab}
		Sd	81.69	62.15	59.30	51.06	12.61
E-I (0.2% protease)	♂	$\bar{x}$	2624.50^{a}	2275.20^{a}	2105.87^{a}	1878.01^{a}	37.43^{c}
		Sd	157.98	140.30	131.38	122.64	11.79
	♀	$\bar{x}$	2279.50^{c}	1976.20^{b}	1848.75^{b}	1650.31^{b}	44.21^{abc}

		Sd	46.93	47.32	47.59	48.79	10.60
E-II (0.3% protease)	♂	$\bar{x}$	2699.^{50a}	2308.14^{a}	2141.09^{a}	1913.06^{a}	38.83^{bc}
		Sd	114.47	112.55	102.47	96.73	9.63
	♀	$\bar{x}$	2327.50^{bc}	2005.61^{b}	1875.86^{b}	1670.49^{b}	53.33^{a}
		Sd	138.23	119.76	118.88	110.90	9.00
p-value							
Source of variation							
Protease			0.005	0.065	0.056	0.066	0.345
Sex			0.001	0.001	0.001	0.001	0.009
Protease x sex			0.908	0.991	0.987	0.959	0.548

$\bar{X}$ -Average, Sd - Standard deviation
$^{a-c}$ Means with different superscripts within columns differ significantly (P<0.05)

The chickens from the feed treatments had similar weights in the dressed carcass yield and abdominal fat weight, from which we conclude that the feed treatments for broilers had no effect on the examined carcass properties (P>0.05), and significance appeared only in pre-slaughter body weight and that between females from C and E-I group (P<0.05). That no differences in differently dressed carcass weights between fast-growing 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) determined by Dosković et al. (2016), while Song et al. (2023) determined that the changes in dietary protein level and supplementation of protease do not affect the carcass yield, but significantly affected abdominal fat content.

Table 1 shows that male broilers had a higher pre-slaughter body weight compared to female chickens, and therefore a higher dressed carcass weights, as well as a lower abdominal fat weight (P<0.05). Numerous researchers have established that males have a greater mass of processed carcasses compared to females (Kamporn and Deeden 2022; Churchil and Sagar 2023).

Table 2. Dressing percentage and abdominal fat percentage (in %)

Groups	Sex		Dressing percentage for conventionally dressed carcass	Dressing percentage for ready-to-roast carcass	Dressing percentage for ready-to-grill carcass	% abd. fat
C (no protease)	♂	$\bar{x}$	85.59	79.78^{bc}	71.24	1.41^{b}
		Sd	2.58	1.27	1.28	0.49
	♀	$\bar{x}$	85.69	80.25^{abc}	71.54	2.00^{a}
		Sd	1.15	1.01	0.76	0.53
E-I (0.2% protease)	♂	$\bar{x}$	86.72	80.24^{abc}	71.55	1.41^{b}
		Sd	1.38	1.37	1.53	0.40
	♀	$\bar{x}$	86.69	81.10^{a}	72.40	1.94^{a}
		Sd	1.07	1.250	1.52	0.46
E-II (0.2% protease)	♂	$\bar{x}$	85.49	79.30^{c}	70.86	1.44^{b}
		Sd	1.32	1.27	1.49	0.35
	♀	$\bar{x}$	86.17	80.58^{ab}	71.75	2.29^{a}
		Sd	1.13	0.94	1.13	0.32
p-value						
Source of variation						
Protease			0.076	0.112	0.223	0.351
Sex			0.514	0.007	0.059	0.001
Protease x sex			0.748	0.567	0.727	0.463

$\bar{X}$ -Average, Sd - Standard deviation
$^{a-c}$ Means with different superscripts within columns differ significantly (P<0.05)

From Table 2 it can be concluded that dressing percentage and abdominal fat percentage were less influenced by dietary treatments and sex of chickens, accordingly that there was no significance under the influence of feed treatments in any of the percentages, as well as the influence of sex on dressing percentage for conventionally dressed carcass and dressing percentage for ready-to-grill carcass ($P>0.05$). Only the females from the E-II group had a higher dressing percentage for ready-to-roast carcass compared to the males, as well as a higher abdominal fat percentage in all three sample groups ($P<0.05$).

Similar results were reached by Dosković et al. (2012) stating that the use of different protein levels and enzyme supplementation in broiler diet showed no statistical significance ($P>0.05$) in dressing percentage of conventionally dressed carcass and percentage of abdominal fat. Mahendran et al. (2022) and Lee et al. (2023) also state that carcass yield were not affected by the supplementation of exogenous protease to diets ($P>0.05$). And Yaqoob et al. (2022) and Yaseen et al. (2024) determined that carcass traits such as dressing percentage and carcass yield were not affected ($P>0.05$) by various dietary treatments (organic acids or protease supplementation in diet). In contrast to these studies, Wealleans et al. (2024) reported that both the multi-protease and the monocomponent serine protease increased carcass weight and carcass yield ($P<0.05$). In their respective studies Ikusika et al. (2020) and Churchill and Sagar (2023) observed that sex has an effect on dressing percentages, while Tanachai et al. (2017) point out that there are no differences between males and females in these characteristics of carcass.

Conclusion

This study shows how reducing the crude protein content with the addition of protease enzymes in broiler diets affects some slaughter indicators, such as carcass weights, abdominal fat weight, dressing percentages and abdominal fat percentage in slow-growing hybrid Master Gris chickens.

Based on the presented results, it can be concluded that the studied dietary treatments did not affect the examined carcass quality traits ($P>0.05$), accordingly, differences appeared between females C and E-I group in live weight ($P<0.05$). The influence of sex on the examined traits of carcass was much greater, as significance was manifested in live weights, all masses of processed carcasses and abdominal fat, as well as dressing percentage for ready-to-roast carcass and abdominal fat percentage ($P<0.05$). Namely, females had a lower pre-slaughter body weight compared to males, and therefore a lower dressed carcass weights, higher abdominal fat weight and abdominal fat percentage, and in the E-II group had a higher dressing percentage for ready-to-roast carcass ($P<0.05$).

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References

Amer S.A., Beheiry R.R., Abdel Fattah D.M., Roushdy E.M., Hassan F.A.M., Ismail T.A., Zaitoun N.M.A., Abo-Elmaaty A.M.A., Metwally A.E. (2021). Effects of different feeding regimens with protease supplementation on growth, amino acid digestibility, economic efficiency, blood biochemical parameters, and intestinal histology in broiler chickens. BMC Veterinary Research, 17, 283.

Attia Y.A., Bovera F., Wang J., Al-Harthi M.A., Kim W.K. (2020). Multiple amino acid supplementations to low-protein diets: effect on performance, carcass yield, meat quality

and nitrogen excretion of finishing broilers under hot climate conditions. Animals, 10(6), 973.

Cowieson A.J., Acamovic T., Bedford M.R., Ravindran V. (2017). Protease supplementation of poultry diets: a review. Journal of Animal Science and Biotechnology, 8(1), 24.

Churchil R.R., Sagar B. (2023). Effect of sex on growth and carcass characteristics of commercial broilers. Indian Journal of Veterinary and Animal Sciences Research, 52(6), 13-22.

Dosković V., Bogosavljević-Bošković S., Pavlovski Z., Milošević B., Škrbić Z., Rakonjac S., Petričević V. (2012). The effect of protease on productive and slaughter traits in broiler chickens. Biotechnology in Animal Husbandry, 28(4), 817-826.

Dosković V., Bogosavljević-Bošković Snežana, Lukić Miloš, Škrbić Zdenka, Rakonjac S., Petričević V. (2016). Effect of protease and duration of fattening period on dressing percentage of broiler chicken. Biotechnology in Animal Husbandry, 32(4), 352-360.

Kamporn K., Deeden B. (2022). Effect of strain and gender on production performance, carcass characteristics and meat quality of broiler chickens. International Journal of Agricultural Technology, 18(2), 567-578.

Ikusika O., Falowo A., Mpendulo C., Zindove T., Okoh A. (2020). Effect of strain, sex and slaughter weight on growth performance, carcass yield and quality of broiler meat. Open Agriculture, 5, 607-616.

Lee J., Oh H., Kim Y., Song D., An J., Chang S., Go Y., Cho H., Lee B., Kim W.K., Cho J. (2023). Effects of exogenous protease on performance, economic evaluation, nutrient digestibility, fecal score, intestinal morphology, blood profile, carcass trait, and meat quality in broilers fed normal diets and diets considered with matrix value. Poultry Science, 102(5), 102565.

Mahendran S., Ramanathan A., Ponnuvel P. (2022). Influence of protease supplementation on carcass traits ofbroilers fed with normal and low protein diets. International Journal of Advanced Research in Biological Sciences, 9(4), 109-117.

Qiu K., Chen J., Zhang G., Chang W., Zheng A., Cai H., Liu G., Chen Z. (2023). Effects of dietary crude protein and protease levels on performance, immunity capacity, and AA digestibility of broilers. Agriculture, 13, 703.

Radhi K.S., Arif M., Rehman A.U., Faizan M., Almohmadi N.H., Youssef I.M., Swelum A.A., Suliman G.M., Tharwat M., Ebrahim A., Abd El-Hack M.E., Mahrose K.M. (2023). Growth performance of broiler chickens fed diets supplemented with amylase and protease enzymes individually or combined. Open Veterinary Journal, 13(11), 1425-1435.

Rodríguez-Soriano F.A., López-Coello C., Ávila-González E., Arce-Menocal J., Fascina V.B., Chárraga-Aguilar S. (2025). Sfericase protease, phytase, and xylanase combination improves body weight, feed conversion rate, ileal digestibility, and gut morphology in broilers. Frontiers in Animal Science, 6, 1453735, doi: 10.3389/fanim.2025.1453735

Song X., Anas M.A., Kurniawati A., Hanim C., Muhlisin, Aprianto M.A., Madani A.M.A., Wang Q., Chen H. (2023). Effects of reduced-protein diets with protease supplementation on growth, carcass yield, intestinal morphology, organ development, nutrient digestibility, and blood biochemical of broiler chickens. Translational Animal Science, 7(1), txad098. doi: 10.1093/tas/txad098.

Tanachai T., Suchon T., Prajit U., Watcharin K., Supunsa A., Boonlom C. (2017). Comparison of production performance and carcass composition of commercial broiler strains 2. Cobb and Ross. Agricultural Science Journal, 48, 217-224.

Yaqoob M.U., Yousaf M., Imran S., Hassan S., Iqbal W., Zahid M.U., Ahmad N., Wang M. (2022). Effect of partially replacing soybean meal with sunflower meal with supplementation of multienzymes on growth performance, carcass characteristics, meat

quality, ileal digestibility, digestive enzyme activity and caecal microbiota in broilers. Animal Bioscience, 35(10), 1575-1584.

Yaseen M.A., Iqbal W., Bhatti S.A., Rehman M.S.U., Subhani A., Shoaib M., Rahman M.A.U., Yaqoob M.U. (2024). Dietary supplementation of protease and organic acid in poultry by-product meal-based diet in broilers. Animal Bioscience, 37(12), 2145-2154.

Wealleans A.L., Ashour R.A., Abu Ishmais M.A., Al-Amaireh S., Gonzalez-Sanchez D. (2024). Comparative effects of proteases on performance, carcass traits and gut structure of broilers fed diets reduced in protein and amino acids. Journal of Animal Science and Technology, 66(3), 457-470.