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RESEARCH ARTICLE

Effect of Dietary Selenium and Vitamin E on Slaughter Yield and Carcass Composition of Commercial White Koluda Geese

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ABSTRACT

Taking into consideration the role of selenium and vitamin E in metabolic processes of living organisms, the effect of these oxidants on slaughter value and carcass quality of commercial goose was investigated. The experiment was carried out on 200 one-day-old White Koluda geese that were randomly divided into two groups: 50 males and 50 females each. From first day until 13th wk of age the control group was maintained on commercial basic feeds, the experimental group received feed enriched with organic selenium (0.3 mg kg^{-1}) and vitamin E (100 mg kg^{-1}). Later on, for three wks all birds were feed with oat grain and cereals ground. At 112 day of live all birds were weighted individually and from each group 20 birds (10 males and 10 females) were chosen randomly, slaughtered and after 24 hours chilling at +4°C the following parameter were evaluated (in grams, exact to 0.1 g and % in relation to live body weight and eviscerated carcass with neck): eviscerated carcass with neck, neck without skin, wings with skin, breast and leg muscles, edible giblets (heart, liver, gizzard), skin with subcutaneous fat, abdomen fat and remainder of carcass. Feed supplementation with tested antioxidants had non-significant ($P \geq 0.05$) effect on evaluated female traits, but significantly increased ($P \leq 0.05$) the male live body weight and eviscerated carcass with neck. Irrespective of feeding group, significant sex differences were stated in majority of evaluated carcass elements.

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INTRODUCTION

In many experiments carried out on the commercial geese, significant differences in dressing percentage, carcass quality, nutritive and technological value of meat, depending on genotype, direction of selection, management system and age and sex of birds has been described (Mazanowski, 2000). Nowadays, in order to fulfill consumers demand and expectation concerning quality of goose originated products, special attention is given to increase the percentage of breast and leg muscles and decrease in fat contents in carcass. Fletcher (2002) and Rosiński (2000) studied the possibility of improving these traits through genetic selection. Other way aiming to this goal is hybrids production via commercial goose crossing with breeds from genetic reserve flocks (Mazanowski, 2000) and wild species - Graylag (*Anser anser* L.) (Chrzanowska and Chelmonska, 2000) or Canada goose (*Branta canadiensis* L.) (Kowalczyk and Lukaszewicz, 2012; Kowalczyk *et al*., 2013).

It is known already, that selenium and vitamin E exhibit compensative effects and as components of antioxidant enzymes and cytochromes support functions of animal immune, reproductive and nervous systems, as well as many metabolic processes, including growth of muscles (Choct *et al*., 2004; Mashkoor *et al*., 2013). Selenium deficiency causes liver and cardiac muscle damages, muscles degeneration, weakens the immune and hormonal systems (Arthur, 1997), while vitamin E deficiency can lead to muscular dystrophy. In some poultry species, the positive effect of feed supplementation with selenium on reproductivity, production efficiency, carcass and meat quality has already been described (Choct *et al*., 2004; Ibrahim *et al.,* 2011; Mikulski *et al.*, 2009; Ghafoor *et al.*, 2010; Yang *et al.,* 2012) however, the number of information related to goose is limited (Baowei *et al*., 2011).

In Poland, geese are the main export products of animal origin. For many years, continue attempts to improve the genotype and environmental conditions of slaughter goose in order to obtain the birds of appropriate final body weight, large share of breast muscles and low abdominal fat level are performed. Taking into account the role of selenium and vitamin E in animal metabolic processes, as well as contemporary European consumer expectations and the importance of geese in the Polish economy of animal originated products, studies on the effect of the most common antioxidants on commercial goose performance were undertaken.

MATERIALS AND METHODS

Two hundred one-day-old White Koluda commercial goslings randomly selected from 1500 chicks were divided into two groups (50 males and 50 females each): The control group maintained on the commercial basic feeds (Table 1) and the experimental group received feed enriched with 0.3 mg kg^{-1} organic selenium (as 300 mg kg^{-1} of selenium yeast - Sel-Plex^{TM}, Alltech LTD, USA) and 100 mg kg^{-1} vitamin E (as 200 mg kg^{-1} of E-50 Adsorbate - Rolimpex S.A). Birds were fed with commercial feeds to 13 wks of age, then both groups were fed with the same way: one week more with oat grain (160 g/day/bird) and cereals ground (250 g/day/bird), later on (until 112 day of live) with both grains *ad libitum*. Birds of both groups were reared in semi-intensive system, *i.e.* during first 3 wks of rearing goslings were kept indoors, under controlled environment (temperature, light program, humidity) then, to 16 week of age, in open house with free access to grass field. Drinking water and commercial feeds were provided *ad libitum*. At Day 112 of live (slaughter day) all birds were weighted individually (exact to 5 g) and from every group 20 birds (10 males and 10 females of body weight closer to the average weight for sex and group) were selected and slaughtered in national slaughter house for waterfowl. Twenty-four hours before slaughter birds were deprived of feed. After 24 hours of carcasses chilling at temperature +4°C the following parameter were evaluated (in grams, exact to 0.1 g and % in relation to live body weight or eviscerated carcass with neck): eviscerated carcass with neck, neck without skin, wings with skin, breast and leg muscles, edible giblets (heart, liver, gizzard), skin with subcutaneous fat, abdomen fat and remainder of carcass. Obtained data were analysed statistically with ANOVA, the significance of differences by Duncan's multiple range test (Statistica, version 8).

Table 1: Chemical composition of the basic (control) feeds provided during goose rearing*

Ingredients	Starter	Grower	Finisher
Dry matters [%]	88.0	88.2	88.9
Proteins [% of d.m.]	23.5	18.7	10.8
Crude fibre [% of d.m.]	3.7	5.0	10.2
Raw fat [% of d.m.]	2.89	2.56	3.79
Calcium [g/kg]	9.59	5.20	1.46
Phosphorus [g/kg]	7.30	5.05	0.10

*Feed analysis was made in the local feed laboratory in Lublin.

RESULTS AND DISCUSSION

The detailed results of the study are presented in Table 2 and Table 3. The final body weight and slaughter yield of 16-wk-old White Koluda ganders maintained on organic selenium and vitamin E supplemented feeds was significantly ($P\leq0.05$) higher comparing to males fed basic feeds (Table 2). The composition of other elements of eviscerated carcass, as well as, the muscle and fat contents were not affected ($P\geq0.05$) by feeds supplementation with tested antioxidants (Table 3).

Irrespective of feeding group, sex differences were stated in relation to eviscerated carcass with neck, breast muscles, wings and edible giblets. Additionally, males from the experimental group were heavier ($P\leq0.05$) and had higher amount of leg muscles, compared to females of the same group.

In the present studies feed supplementation with 0.3 mg kg^{-1} of organic selenium and 100 mg kg^{-1} vitamin E had no significant effect on the average final body weight and carcass characteristics of 16 wks old, oat fattened commercial geese derived from *Anser anser* L. ancestor. The only exception was the weight of final body and eviscerated carcass with neck of the males. Feed additives affected positively these traits. The *post mortem* analysis also revealed no significant effects of the tested antioxidants on the percentage of breast and leg muscles and skin with subcutaneous fat. However, it should be underlined that in the experimental groups (both male and female) values of most analyzed parameters were higher, compared to the control group, except the contents of skin with subcutaneous fat, which was almost on the same level. Our other studies showed, on one hand no effect of selenium on final body weight of goose, while on the other decreased significantly the thickness of subcutaneous fat with skin measured on alive birds (Lukaszewicz *et al*., 2011). Documented differences in male and female body weights and carcass values result from sexual dimorphism, which in case of commercial lines derived from *Anser anser* L. goose is observed already from 4 wk of age (Bochno *et al*., 2006).

Similarly to our experiment, the results of numerous studies confirmed the lack of selenium (inorganic or organic forms) supplementation effect on final body weight, slaughter yield and performances in geese (Baowei *et al*., 2011), chicken broilers (Deniz *et al*. 2005; Ibrahim *et al.,* 2011; RamaRao, 2013; Wang and Xu, 2008; Yang *et al*., 2012, Yoon *et al.,* 2007), and turkeys (Mikulski *et al*., 2009). No selenium (0.3 mg Sel-Plex) effect on carcass composition and dressing percentage has been described by Heindl *et al*. (2010). However, when mentioned authors used a half lower dose of this bioelement significant influence of selenium on body weight has been observed.

Contrary to our results, Skřivan *et al*. (2008) indicated a positive effect of dietary selenium supplementation on broiler body weight at 42 d of age, while Choct *et al*. (2004) concluded that male broilers receiving dietary organic selenium exhibited improved eviscerated weight and breast yield. Varied impact of analyzed antioxidants on slaughter yield and meat characteristics confirm also studies of other authors. For example, the Krstić *et al*. (2012) who studied the effect of various levels of sodium selenite and Se-enriched yeast on chicken performance and carcass quality, concluded that chicks in all Se-supplemented treatments (regardless of selenium source) had significantly higher final body weight (at D 42) and eviscerated weight compared to groups maintained on basic feeds. However, as in our study, the carcass yield (%) and breast, thigh and wing

Table 2: Effect of dietary selenium and vitamin E on live body weight, slaughter yield and carcass composition of White Koluda goose (means±SD)

Evaluated trait	Control		Experimental	
	Weight (g)	(%)	(g)	(%)
Groups ♂ (n=10)				
Live body weight	7000±138[a]	100	7194±48[b]	100
Eviscerated carcass with neck	4550±94[a]	65.01±1.1	4778±96.2[b]	66.41±1.2
Breast muscles	731±61.3	10.44±0.9	784±50.2	10.90±0.7
Leg muscles	626±71.5	8.95±1.03	674±70.4	9.38±1.00
Skin with subcutaneous fat	1056±68.6	15.08±0.9	1108± 67.9	15.40±0.9
Abdominal fat	214±34.8	3.06±0.49	246±33.9	3.41±0.47
Neck without skin	272±15.4	3.89±0.24	276±13.1	3.84±0.17
Wings with skin	658±24.3	9.41±0.41	680.3±38.1	9.46±0.55
Edible giblets	417±28.3	5.96±0.40	413±17.9	5.75±0.26
Remainder of carcass	993±86.4	14.18±1.2	1009±59.7	14.02±0.85
Groups ♀ (n=10)				
Live body weight	6290±57	100	6337±76	100
Eviscerated carcass with neck	4174±260	66.35±3.8	4212±117	66.46±1.3
Breast muscles	665±36.6	10.57±0.6	697±42.0	11.00±0.7
Leg muscles	560±33.0	8.91±0.55	561±40.4	8.85±0.58
Skin with subcutaneous fat	1027±117	16.32±1.8	1024±55.5	16.16±0.7
Abdominal fat	229±36.9	3.64±0.58	253±39.3	3.99±0.61
Neck without skin	222±14.9	3.53±0.24	222±15.1	3.50±0.23
Wings with skin	552±22.1	8.78±0.38	578±22.3	9.12±0.31
Edible giblets	362±23.4	5.15±1.85	382±31.9	6.03±0.53
Remainder of carcass	920±53.9	14.60±3.9	877±60.9	13.84±1.0
Groups ♂ and ♀ (n=20)				
Live body weight	6645±378	100	6765±444*[2)]	100
Eviscerated carcass with neck	4362±271*	65.68±2.8	4495±308*	66.43±1.2
Breast muscles	698±59.8*	10.50±0.7	741±63.5*	10.95±0.7
Leg muscles	593±63.9	8.93±0.80	618±80.6*	9.12±0.84
Skin with subcutaneous fat	1041±94.4	15.70±1.5	1066±74.1	15.78±0.9
Abdominal fat	222±35.8	3.35±0.60	249±35.9	3.70±0.61
Neck without skin	247±29.6	3.71±0.30	249±31.1	3.67±0.26
Wings with skin	605±59.1*	9.09±0.50	629±60.8*	9.29±0.47
Edible giblets	389±38.0*	5.55±1.36	398±29.8*	5.89±0.43
Remainder of carcass	956±188[a]	14.39±2.8	943 a±89.4	13.94±0.9

Average values in lines with different superscripts differ significantly between groups (P≤0.05).

Table 3: Effect of dietary selenium and vitamin E on musculature and fatness of White Koluda goose carcass (means±SD)*

Groups		Breast muscles	Leg muscles	Muscles in total	Skin with subcutaneous fat	Abdominal fat
♂ (n=10)	Control	16.1±1.2	13.8±1.5	29.8±2.5	23.2±1.4	4.7±0.8
	Experimental	16.4±0.9	14.1±1.5	30.5±2.0	23.2±1.2	5.1±0.7
♀ (n=10)	Control	15.9±1.2	13.5±1.2	29.4±2.4	24.6±2.7	5.5±0.9
	Experimental	16.6±0.9	13.3±0.9	29.9±1.3	24.3±2.9	6.0±0.9
♂ & ♀	Control	16.0±1.1	13.6±1.3	29.6±2.4	23.9±2.2	5.1±0.9
(n=20)	Experimental	16.5±0.9	13.7±1.3	30.2±1.7	23.7±1.2	5.6±0.9

*Percentage contents in relation to eviscerated carcass with neck.

weight (g) were not dependent on the diet applied. Ševčíková *et al.* (2006) found significant effect of dietary selenium supplementation on broiler performance, but no differences in carcass characteristic (weight of breast and thigh muscle, liver, giblets, abdominal fat and carcass yield).

Differences in selenium effect presented in our experiment and cited above authors may partly result from various origins of birds, and a way of their keeping, but show different and very often opposite impact of the tested antioxidative additives. In case of geese this can be more understandable, because usually they are kept in semi-intensive system and during a large part of life have an access to pasture or green fodder fed. Depending on latitude and season additionally supported feeds can be of different value, affecting differences in growth performance.

Conclusion: Due to lack of improvement in slaughter yield and percentage of breast and leg muscle in carcasses of goose fed with feeds of higher content of selenium and vitamin E further experiments on selenium and vitamin E supplementation, provided in different doses or rearing period, can be recommended.

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