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Slaughter yield and meat quality of hybrid derived from crosses between Canada Goose (*Branta canadensis* L.) males and White Kołuda (*Anser anser* L.) goose females

Schlachtausbeute und Fleischqualität von Hybridgänsen aus der Kreuzung von Gantern der Kanadagans (*Branta canadensis* L.) und Weißen Koluda Gänsen (*Anser anser* L.)

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Introduction

In order to satisfy the expectations of consumers concerning quality features of poultry carcasses, a selection is directed mainly at increase of growth rate, slaughter yield and at decrease of fatness (Berri, 2000). Such selection directions may have a detrimental influence on the nutritional value of meat by the limitation of the gene pool caused by an increase in flock homozygosity (Powell, 1992; Smith et al., 1993). Another way of improving the performance and quality of poultry products may be either the utilisation of individuals sourced from genetic reserve flocks (Mazanowski, 2000) with very good proportions of muscle contents and low adiposity or the application of crossbreeding with wild geese which are characterised by favourable tissue composition (Chełmońska et al., 1995).

Previous studies point to the possibility of obtaining intergeneric hybrids of Greylag Goose or Canadian Goose with commercial lines of the domestic goose. Chrzanowska and Chełmońska (1997) using AI with fresh semen in crossing Graylag ganders with White Kołuda geese reported egg fertility at 76.7%, while using frozen-thawed semen only 25.0% of fertile eggs was obtained (Łukaszewicz et al., 2004). After the insemination of White Kołuda goose with the freshly collected semen of Canada Goose, 87.6% of fertilised eggs were obtained (Kowalczyk and Łukaszewicz, 2012). Moreover, the physiological barrier created by the six-week reproduction period of the Canada Goose, which is short when compared to the six-month period of the White Kołuda goose, may be omitted when using cryopreserved semen, which allows a larger number of goslings to be obtained in one reproduction season. After twice-weekly insemination with frozen-thawed semen, 62.0% of fertilized eggs on average were obtained (Kowalczyk and Łukaszewicz, 2012).

Taking into account the increasing interest in the production of high nutritive value raw materials of animal origin, the aim of the present study was an assessment and comparison of slaughter yield, carcass composition and selected physicochemical features of breast muscles of hybrids obtained via artificial insemination of White Kołuda (*Anser anser* L.) goose with the semen of Canada Goose (*Branta canadecsis* L.) gander, in relation to the commercial White Kołuda goose.

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Materials and methods

The experimental group consisted of 64 (32♂ and 32♀) one-day-old intergeneric hybrids (BxWK) derived after artificial insemination of White Kołuda goose with semen of Canada Goose (*Branta canadensis* L.) (Kowalczyk and Łukaszewicz, 2012) while the control group was composed of 32♂ and 32♀ commercial White Kołuda geese (WK). On the day of hatching all birds were sexed, marked individually and divided randomly into 8 replicates (4♂ and 4♀, each). Goslings of both groups were treated the same way: during the first six weeks they were kept indoors on a deep litter, under controlled temperature, lighting program and humidity, then in an open house with unlimited access to pasture. From 1 to 3 week of age all goslings were fed with a commercial mixture containing 20.0% crude protein, 0.48% methionine, 1.10% lysine, 11.9 MJ ME and 5.00% crude fibre; then, from 4 to 14, or to 21 week, with feed containing 17.0% crude protein, 0.43% methionine, 0.90% lysine, 11.5 MJ ME/kg and 7.00% crude fibre. Subsequently, during the next three weeks (*i.e.* up to 17 or 24 weeks) geese were fed exclusively with oat grain, containing 11.8% crude protein and 10.8 MJ ME/kg. During the entire rearing period feeds and drinking water were provided *ad libitum*. The amounts of feed both, initially administered and also later left uneaten were weighed for every group and replicate, so feed consumption per bird for every supplied feed (commercial mixtures and oat grain) and feed conversion rates for cumulative feeds were calculated.

At the 17th and 24th week of rearing all birds were weighed individually, then five males and five females of body weights close to the average weight for group and sex were selected from each group, slaughtered, eviscerated and after 24 hours of cooling at 4°C the following carcass parameters were analysed (according to Ziołecki and Doruchowski, 1989): eviscerated carcass with neck, breast and leg muscles, edible giblets (heart, liver, gizzard), skin with subcutaneous fat, abdominal fat, neck without skin, wings with skin, and carcass residues.

In the left breast muscles (*pectoralis major*) the pH value was measured 15 minutes (pH_{15}) after slaughter and after 24 hours (pH_{24}) of cooling at 4°C, using a spear tip electrode combined with a pH-meter (CP-401, Elmetron, Zabrze,

Poland). The electrode was placed at an angle of 45°, halfway through the muscle. On the inner side of the right muscle (*pectoralis major)* the meat colour (values: L^*, a^*, b^*) was measured after 24 hours of cooling with the use of colorimeter (Konica Minolta CR-400/410, Osaka, Japan). The right muscles were minced and homogenized for water holding capacity (WHC) evaluation, by a modified version of the Grau and Hamm (1952) method.

All data obtained were analysed with ANOVA, and the significance of differences between means was tested by Duncan's multiple range test (Statistica, version 8.0).

The experiment was conducted with the permission of the II Local Ethics Commission for Experiments Carried out on Animals and was financially supported by the Ministry of Science and Higher Education, BS/2010.

Results

At the 17th (26.9 kg) and 24th week (39.2 kg) of rearing feed consumption was lower for the BxWK hybrid ($P < 0.05$) than for the WK goose (30.6 kg vs. 47.2 kg), while higher FCR was observed in hybrids, 5.19 kg at 17th and 6.98 kg at 24th week, than in WK geese (4.75 kg and 5.95 kg, respectively).

Body weight before slaughter and weight of carcass eviscerated with neck of 17- (Table 1) and 24-week-old (Table 2) hybrids was lower ($P < 0.05$) compared to the WK, while the slaughter yield did not differ statistically. Both, at the 17th and 24th week lower ($P < 0.05$) leg muscles weight was noted in BxWK, by 86.0 and 201 g compared to WK. Despite the significantly ($P < 0.05$) lower carcass weight of BxWK hybrids, the weight and the proportion of breast muscles was significantly higher ($P < 0.05$; by 6.40 and 7.90, respectively) in BxWK hybrids in 17th (Table 1) and 24th (Table 2) week of age. Moreover, at the 17th week of age the proportion of leg muscles was by 1.50% higher comparing to commercial WK (Table 1).

Compared to WK carcasses, BxWK carcasses were characterised by a lower ($P < 0.05$) weight of skin with subcutaneous fat and abdominal fat, by 545 and 133 g (17th week) and by 803 and 222 g (24th week), respectively. The percentage of skin with subcutaneous fat and abdominal fat in BxWK carcasses was lower ($P < 0.05$), by 8.00 and 2.14% at the 17th week, and 8.50 and 2.31% at the 24th week, when compared to WK carcasses (Table 1 and 2). At both slaughter ages, the weight of neck, wings, carcass residue and edible giblets of BxWK hybrids was lower ($P < 0.05$) than of WK geese. Only the percentage contribution of wings in the carcass of BxWK hybrids was significantly ($P < 0.05$) higher (Table 1 and 2).

The breast muscles of 17- (Table 3) and 24-week-old (Table 4) hybrids were characterised by lighter colour (L^*) ($P < 0.05$) and higher intensity of yellowness (b^*) than in WK commercial geese. With respect to other physicochemical properties of the muscles, no statistical differences were noted.

Within the range of assessed genetic groups, the males differed from the females with respect to the assessed features, however the sexual dimorphism in BxWK was lower than in WK geese (Table 1 and 2).

Comparative analysis of the influence of the rearing period length of BxWK hybrids on the percentage contribution of particular carcass components demonstrated higher

Table 1. Comparison of body weight, slaughter yield and carcass composition of 17-week-old hybrids (BxWK) of Canada Goose males and White Kołuda goose females *vs.* commercial White Kołuda (WK) goose (means ± SD)
Vergleich von Lebendgewicht, Schlachtausbeute und Schlachtkörperzusammensetzung von 17 Wochen alten Hybriden (BxWK) aus Kanada Gantern (B) und Weißen Koluda Gänsen (WK) mit kommerziellen Weißen Koluda Gänsen (Mittelwerte ± SD)

Trait	Unit	Group – sex					
		Hybrids BxWK			Commercial WK		
		♂ (n = 5)	♀ (n = 5)	♂♀ (n = 10)	♂ (n = 5)	♀ (n = 5)	♂♀ (n = 10)
Body weight	(g)	$5236^{b} \pm 538$	$4989^{b} \pm 324$	$5112^{b} \pm 438$	$6938^{a} \pm 433$	$6233^{a} \pm 186$	$6585^{a*} \pm 486$
Carcass weight	(g)	$3690^{b} \pm 423$	$3503^{b} \pm 263$	$3597^{b} \pm 346$	$4873^{a} \pm 349$	$4381^{a} \pm 136$	$4627^{a*} \pm 360$
Slaughter yield	(%)	70.4 ± 1.20	70.2 ± 1.00	70.3 ± 1.03	70.2 ± 1.34	70.3 ± 0.70	70.3 ± 1.02
Breast muscles	(g)	874 ± 89.1	832 ± 68.7	853 ± 78.1	813 ± 92.7	796 ± 48.6	805 ± 73.7
	(%)	$23.7^{a} \pm 1.21$	$23.8^{a} \pm 2.14$	$23.8^{a} \pm 1.64$	$16.7^{b} \pm 1.40$	$18.2^{b} \pm 0.72$	$17.4^{b} \pm 1.32$
Legs muscles	(g)	$560^{b} \pm 89.6$	546 ± 71.4	$553^{b} \pm 76.8$	$660^{a} \pm 87.0$	618 ± 42.4	$639^{a} \pm 68.2$
	(%)	$15.2^{a} \pm 1.42$	15.5 ± 1.03	$15.3^{a} \pm 1.20$	$13.5^{b} \pm 0.90$	14.1 ± 0.54	$13.8^{b} \pm 0.80$
Skin with subcutaneous fat	(g)	$618^{b} \pm 138$	$652^{b} \pm 117$	$635^{b} \pm 122$	$1215^{a} \pm 84.1$	$1145^{a} \pm 51.0$	$1180^{a} \pm 75.3$
	(%)	$16.6^{b} \pm 2.00$	$18.5^{b} \pm 2.20$	$17.5^{b} \pm 2.21$	$24.9^{a} \pm 0.81$	$26.1^{a} \pm 0.83$	$25.5^{a} \pm 1.00$
Abdominal fat	(g)	$111^{b} \pm 44.9$	$142^{b} \pm 44.5$	$127^{b} \pm 45.1$	$257^{a} \pm 57.9$	$264^{a} \pm 40.4$	$260^{a} \pm 47.2$
	(%)	$3.00^{b} \pm 0.91$	$4.00^{b} \pm 1.04$	$3.50^{b} \pm 1.04$	$5.24^{a} \pm 0.90$	$6.04^{a} \pm 1.02$	$5.64^{a} \pm 1.00$
Neck without skin	(g)	$194^{b} \pm 21.1$	$184^{b} \pm 14.8$	$189^{b} \pm 17.9$	$289^{a} \pm 29.1$	$231^{a} \pm 18.6$	$260^{a*} \pm 38.1$
	(%)	$5.30^{b} \pm 0.61$	5.30 ± 0.30	5.30 ± 0.44	$5.92^{a} \pm 0.32$	5.30 ± 0.30	$5.60^{*} \pm 0.33$
Wings with skin	(g)	$602^{b} \pm 33.4$	540 ± 25.9	$571^{b*} \pm 42.8$	$685^{a} \pm 36.7$	574 ± 20.1	$630^{a*} \pm 64.5$
	(%)	$16.4^{a} \pm 1.12$	$15.5^{a} \pm 1.50$	$16.0^{a} \pm 1.32$	$14.1^{b} \pm 0.43$	$13.1^{b} \pm 0.30$	$13.6^{b} \pm 0.61$
Remainder of carcass	(g)	$730^{b} \pm 99.7$	$604^{b} \pm 28.4$	$667^{b*} \pm 95.7$	$952^{a} \pm 27.4$	$750^{a} \pm 33.6$	$851^{a*} \pm 110$
Edible giblets	(g)	$298^{b} \pm 30.9$	$288^{b} \pm 38.3$	$293^{b} \pm 33.3$	$396^{a} \pm 42.6$	$346^{a} \pm 13.0$	$371^{a} \pm 39.4$

^{a,b} – average values in rows and the same sex with different letters differ significantly ($P < 0.05$),
* – significant differences between males and females within group ($P < 0.05$).

Table 2. Comparison of body weight, slaughter yield and carcass composition of 24-week-old hybrids (BxWK) of Canada Goose males and White Kołuda goose females *vs.* commercial White Kołuda (WK) goose (means ± SD)
Vergleich von Lebendgewicht, Schlachtausbeute und Schlachtkörperzusammensetzung von 24 Wochen alten Hybriden (BxWK) aus Kanada Gantern (B) und Weißen Koluda Gänsen (WK) mit kommerziellen Weißen Koluda Gänsen (Mittelwerte ± SD)

Trait	Unit	Group – sex					
		Hybrids BxWK			Commercial WK		
		♂ (n = 5)	♀ (n = 5)	♂♀ (n = 10)	♂ (n = 5)	♀ (n = 5)	♂♀ (n = 10)
Body weight	(g)	5757^{b} ± 345	5566^{b} ± 240	5661^{b} ± 298	7980^{a} ± 488	7880^{a} ± 426	7930^{a} ± 435
Carcass weight	(g)	4105^{b} ± 255	3977^{b} ± 185	4041^{b} ± 221	5689^{a} ± 386	5617^{a} ± 343	5653^{a} ± 346
Slaughter yield	(%)	71.3 ± 0.70	71.5 ± 0.91	71.4 ± 0.77	71.3 ± 0.73	71.3 ± 1.30	71.3 ± 1.00
Breast muscles	(g)	977 ± 45.2	1004 ± 115	990 ± 83.8	961 ± 78.6	908 ± 39.0	934 ± 64.8
	(%)	23.8^{a} ± 0.91	25.2^{a} ± 1.94	24.5^{a} ± 1.60	16.9^{b} ± 1.64	16.2^{b} ± 1.12	16.6^{b} ± 1.40
Legs muscles	(g)	587^{b} ± 53.0	534^{b} ± 31.0	561^{b} ± 49.5	792^{a} ± 35.0	732^{a} ± 41.6	762^{a*} ± 48.4
	(%)	14.3 ± 0.63	13.4 ± 0.90	13.9 ± 0.74	14.0 ± 0.94	13.0 ± 0.70	13.5 ± 0.91
Skin with subcutaneous fat	(g)	782^{b} ± 97.2	811^{b} ± 34.8	796^{b} ± 70.6	1497^{a} ± 245	1703^{a} ± 197	1600^{a*} ± 236
	(%)	19.0^{b} ± 1.40	20.4^{b} ± 1.30	19.7^{b} ± 1.43	26.2^{a} ± 2.80	30.2^{a} ± 2.00	28.2^{a*} ± 3.12
Abdominal fat	(g)	214^{b} ± 31.4	245^{b} ± 16.1	229^{b} ± 28.8	395^{a} ± 68.1	509^{a} ± 41.9	452^{a*} ± 80.1
	(%)	5.20^{b} ± 0.54	6.20^{b} ± 0.24	5.70^{b} ± 0.62	6.93^{a} ± 0.90	9.10^{a} ± 1.00	8.01^{a*} ± 1.41
Neck without skin	(g)	202^{b} ± 8.82	165^{b} ± 11.0	183^{b*} ± 20.8	300^{a} ± 10.1	245^{a} ± 16.2	273^{a*} ± 31.7
	(%)	4.93 ± 0.24	4.20 ± 0.30	4.54* ± 0.50	5.30 ± 0.43	4.40 ± 0.50	4.84* ± 0.64
Wings with skin	(g)	588^{b} ± 45.8	544^{b} ± 47.1	566^{b} ± 49.6	733^{a} ± 45.3	630^{a} ± 42.4	681^{a} ± 68.3
	(%)	14.4^{a} ± 1.20	13.7^{a} ± 0.70	14.0^{a} ± 1.02	12.9^{b} ± 0.70	11.2^{b} ± 0.50	12.1^{b*} ± 1.04
Remainder of carcass	(g)	753^{b} ± 70.4	671^{b} ± 35.0	712^{b} ± 68.0	1008^{a} ± 63.3	888^{a} ± 130.4	948^{a*} ± 115.5
Edible giblets	(g)	288^{b} ± 35.2	287^{b} ± 27.9	287^{b} ± 30.0	408^{a} ± 22.4	436^{a} ± 24.9	422^{a} ± 26.8

^{a,b} – average values in rows and the same sex with different letters differ significantly ($P < 0.05$),
* – significant differences between males and females within group ($P < 0.05$).

Table 3. Comparison of physical and chemical characteristics of the breast muscles of 17-week-old hybrids (BxWK) of Canada Goose males and White Kołuda goose females *vs.* commercial White Kołuda (WK) goose (means ± SD)
Vergleich von physikalischen und chemischen Charakteristika von 17 Wochen alten Hybriden (BxWK) aus Kanada Gantern (B) und Weißen Koluda Gänsen (WK) mit kommerziellen Weißen Koluda Gänsen (Mittelwerte ± SD)

Trait	Unit	Group – sex					
		Hybrids BxWK			Commercial WK		
		♂ (n = 5)	♀ (n = 5)	♂♀ (n = 10)	♂ (n = 5)	♀ (n = 5)	♂♀ (n = 10)
Muscles pH	pH_{15}	6.00 ± 0.10	6.02 ± 0.08	6.01 ± 0.04	5.96 ± 0.12	6.03 ± 0.13	6.00 ± 0.09
	pH_{24}	5.87 ± 0.06	5.93 ± 0.03	5.90 ± 0.04	5.97 ± 0.08	6.00 ± 0.06	5.98 ± 0.07
Color of muscles	L^{*}	42.6 ± 2.42	44.2^{a} ± 2.40	43.4^{a} ± 2.41	41.9 ± 2.30	40.1^{b} ± 1.21	41.0^{b} ± 2.04
	a^{*}	18.0 ± 4.70	19.2 ± 1.60	18.6 ± 5.71	18.0 ± 1.50	17.9 ± 1.21	18.0 ± 1.24
	b^{*}	4.20 ± 2.40	5.24^{a} ± 1.00	4.70^{a} ± 1.80	3.33 ± 2.24	2.83^{b} ± 0.50	3.10^{b} ± 1.54
WHC[1]	%	86.1 ± 7.44	79.5 ± 5.00	82.8 ± 7.00	82.2 ± 4.00	79.2 ± 2.53	80.7 ± 3.50

^{a,b} – average values in rows and the same sex with different letters differ significantly ($P < 0.05$),
[1] – water holding capacity.

($P < 0.05$) proportion of leg muscles (by 1.40%) at the 17th week than at the 24th week, with a concurrent lack of statistical differences in breast muscle proportion. Moreover, 24-week-old hybrids were characterised by significantly ($P < 0.05$) higher (by 2.20%) proportion of skin with subcutaneous fat and abdominal fat (Figure 1). A comparison of physical features of breast muscles of 17 and 24-week-old BxWK hybrids did not demonstrate statistical differences.

Discussion

The mean body weight of 17- (5112 g) and 24-week-old (5661 g) intergeneric hybrids (BxWK) of Canada Goose males with White Kołuda goose females was comparable to the 4925 g obtained in 17-week-old hybrids of Greylag ganders with White Kołuda goose and the 5385 g in 24-week-old hybrids of Slovak goose crossed with Greylag and

Table 4. Comparison of physical and chemical characteristics of the breast muscles of 24-week-old hybrids (BxWK) of Canada Goose males and White Kołuda goose females *vs.* commercial White Kołuda (WK) goose (means ± SD)
Vergleich von physikalischen und chemischen Charakteristika von 24 Wochen alten Hybriden (BxWK) aus Kanada Gantern (B) und Weißen Koluda Gänsen (WK) mit kommerziellen Weißen Koluda Gänsen (Mittelwerte ± SD)

Trait	Unit	Group – sex					
		Hybrids BxWK			Commercial WK		
		♂ (n = 5)	♀ (n = 5)	♂♀ (n = 10)	♂ (n = 5)	♀ (n = 5)	♂♀ (n = 10)
Muscles pH	pH_{15}	6.01 ± 0.10	6.04 ± 0.19	6.02 ± 0.15	5.94 ± 0.26	6.02 ± 0.18	5.98 ± 0.24
	pH_{24}	5.83 ± 0.03	5.88 ± 0.09	5.85 ± 0.07	5.90 ± 0.07	5.96 ± 0.06	5.93 ± 0.08
Color of muscles	L^*	42.2 ± 2.30	42.5[a] ± 2.71	42.4[a] ± 2.44	40.7 ± 2.54	38.8[b] ± 2.00	39.7[b] ± 2.53
	a^*	18.8 ± 1.01	19.1 ± 1.6	19.0 ± 1.30	17.8 ± 0.84	18.9 ± 0.60	18.3 ± 0.90
	b^*	5.5 ± 1.50	6.7[a] ± 0.64	6.1[a] ± 1.20	4.5 ± 1.52	3.9[b] ± 1.74	4.2[b] ± 1.60
WHC[1]	%	84.8 ± 3.63	86.9 ± 1.82	85.9 ± 2.91	84.8 ± 4.80	82.9 ± 3.03	83.8 ± 3.73

[a,b] – average values in rows and the same sex with different letters differ significantly ($P < 0.05$),
[1] – water holding capacity.

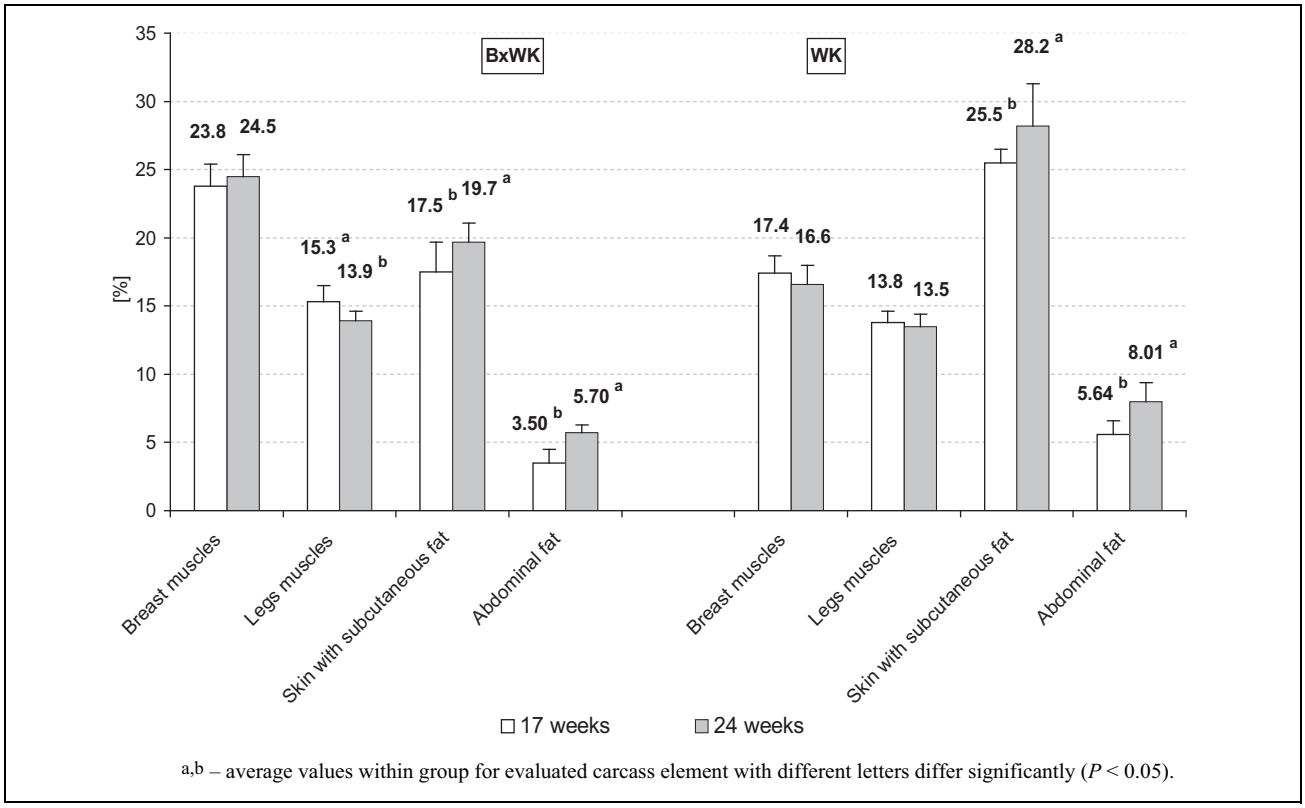

Figure 1. Comparison of the selected carcass elements of intergeneric hybrids (BxWK) and commercial White Kołuda (WK) goose at 17 and 24 week of rearing (n = 10; means ± SD)
Vergleich von ausgewählten Schlachtkörpermerkmalen bei den Zwischenarten-Hybriden (BxWK) und den kommerziellen Weißen Koluda Gänsen (WK) im Alter von 17 und von 24 Wochen (n = 10; Mittelwerte ± SD)

White Kołuda goose (Chrzanowska and Chełmońska, 2000; Mazanowski and Chełmońska, 2000).

The weight of carcass eviscerated with neck of BxWK hybrids was clearly higher, and the difference was from 597 to 830 g after 17 weeks of rearing, and 1013 g after 24 weeks when compared to hybrids of geese with the contribution of Greylag ganders. This points to the dissimilarity of the examined BxWK hybrids when compared to those created with the contribution of Greylag geese, which was also confirmed in the slaughter yield of the assessed birds, which in 17- and 24-week-old BxWK hybrids was higher on average by 10.0 and 8.00% (Chrzanowska and Chełmońska, 2000; Mazanowski and Chełmońska, 2000; Mazanowski et al., 2005). The slaughter yield obtained in the present study is comparable to those observed in Turkish regional goose breeds and commercial White Kołuda goose (Isguzar and Pingel, 2003; Łukaszewicz, 2006). This proves the positive effect of Can-

ada Goose genes on the performance results of the hybrids created with its participation.

Compared with turkey or chicken broilers, goose has a relatively low muscle content and a high adipose tissue content (Bochno et al., 2006), therefore, in order to increase the demand for goose meat, attention should be paid to the improvement of the slaughter yield of carcasses, and especially to increase in the proportion of breast and legs muscles in a carcass (Isguzar and Pingel, 2003). Consumer expectations concerning qualitative features of the carcass may be satisfied by the analysed BxWK hybrids, since their carcasses are characterised (at the 17th and 24th week of rearing) by 6.40 and 7.90% higher proportion of breast muscles, and by 8.25% lower average proportion of skin with subcutaneous fat when compared to the control commercial WK geese. Also, Łukaszewicz et al. (2008) noted in 17-week-old White Kołuda goose a 7.60% lower proportion of breast muscles, and a 6.30% higher proportion of skin with subcutaneous fat when compared to examined BxWK hybrids. Hybrids of Greylag goose with White Kołuda and Slovak geese were also characterised by a lower (by 5.10 and 3.10%) proportion of breast muscles, and a higher (by 4.90 and 2.80%) proportion of skin with subcutaneous fat (Mazanowski and Chełmońska, 2000; Mazanowski et al., 2005). Similarly, the quadruples of Swan Goose (*Anser cygnoides* L.) with White Kołuda goose and those of regional breeds had a 5.30 and 5.10% lower proportion of breast muscles, and a 6.30 and 4.50% higher proportion of skin with subcutaneous fat at the 17th and 24th week (Lisowski et al., 2008). It may be assumed on that basis that the carcasses of BxWK hybrids would be considered by consumers as being of a good tissue composition and low adiposity.

The proportion of wings, neck and edible giblets in carcasses of 17- and 24-week-old BxWK hybrids was comparable to those observed in hybrids of WK goose with Polish regional goose varieties (Mazanowski, 2000).

Colour is one of the first characteristics noticed by consumers when buying meat or meat products (Fanatico et al., 2007). The difference in breast muscle colour observed in the present study is presumably caused by myoglobin proportion, which depends on bird origin and age (Fletcher, 2002). The breast muscles of BxWK hybrids were lighter (L^*) and characterised by a higher intensity of yellowness (b*) when compared to other Polish breeds and varieties of regional goose (Okruszek et al., 2008; Gumułka et al., 2009).

The rearing duration of commercial geese should be established based on production costs and the proportion of particular carcass components (Murawska and Bochno, 2008). The tendencies for changes in the percentage contribution of carcass components of BxWK hybrids at the 17th and 24th week were similar to those noted in WK hybrids with regional varieties (Mazanowski, 2000). It was demonstrated in the present study that prolongation of the rearing and fattening periods of BxWK hybrids from 17 to 24 weeks increased carcass weight (by 444 g on average), however it caused a decrease in leg muscles proportion (with a comparable proportion of breast muscles), and increased the proportion of skin with subcutaneous and abdominal fat. For these reasons, the rearing of BxWK hybrids with oat fattening to the 17th weeks is recommended.

The above results prove that crossing Canada Goose ganders when creating intergeneric hybrids with White Kołuda goose allows to obtain slaughter birds with carcasses characterised by a good slaughter performance, by a high proportion of breast muscles of unchanged physicochemical properties, and by a low proportion of skin with subcutaneous and abdominal fat. Moreover, the lack of sexual dimorphism of the hybrids results in a goose with levelled performance traits, which is desirable from a technological point of view.

Summary

The presented work compares commercial White Kołuda (*Anser anser* L.) goose with an experimental cross of Canada Goose (*Branta canadensis* L.) with White Kołuda. A total of 32 males and 32 females from each mating were used in this study. The rearing and fattening with oats was done up to the 17th and 24th week of life. At weeks 17 and 24, five males and five females from each group were randomly selected, slaughtered and the carcasses were subjected to dissection to determine: slaughter yield, weight and percentage contribution of separated elements in eviscerated carcasses with neck, and physicochemical features of the breast muscles.

Body weight before slaughter and weight of carcass eviscerated with neck of 17 and 24-week-old hybrids was lower ($P < 0.05$) compared to the commercial WK. The slaughter yield was not different. At the 17th and 24th week, the BxWK carcasses were characterised in comparison to WK by 6.40 and 7.90% higher proportions of breast muscles ($P < 0.05$), while the amount of skin with subcutaneous fat and abdominal fat was lower ($P < 0.05$) by 8.00 and 2.14%, and 8.50 and 2.31%, respectively. The breast muscles of hybrids were characterised ($P < 0.05$) by a lighter colour (L^*) and intensity of yellowness (b*) than WK goose. Compared to 24 weeks old geese carcasses of 17-week-old hybrids showed similar percentage of breast muscles with a higher ($P < 0.05$) proportion of leg muscles, while a lower ($P < 0.05$) share of skin with subcutaneous fat and abdominal fat.

Intergeneric hybridization of Canada Goose and commercial White Kołuda goose results in hybrids with carcasses characterised by a good slaughter performance, high proportion of breast muscles and a low one of skin with subcutaneous and abdominal fat, which presumably will satisfy consumer expectations. Moreover, the lack of sexual dimorphism among the hybrids enables a goose of levelled performance which is desirable from a technological point of view.

Key words

Goose, intergeneric hybrid, slaughter yield, carcass composition, meat quality

Zusammenfassung

Schlachtausbeute und Fleischqualität von Hybridgänsen aus der Kreuzung von Gantern der Kanadagans (*Branta canadensis* L.) und Weißen Koluda Gänsen (*Anser anser* L.)

In der vorliegenden Studie wurden kommerzielle Weiße Koluda Gänse (WK; *Anser anser* L.) mit einer Kreuzung aus Kanada Gänsen (*Branta canadensis* L.; BxWK) und WK verglichen. Insgesamt wurden 32 Ganter und 32 Gänse von jedem Genotyp verwendet. Die Gänse wurden bis zur 17. bzw. bis zur 24. Lebenswoche mit Hafer gefüttert. Sowohl in der 17. als auch in der 24. Lebenswoche wurden 5 Ganter und 5 Gänse jedes Genotyps zufällig ausgewählt, geschlachtet und die Schlachtkörper zerlegt. Folgende Merkmale wurden bestimmt: Schlachtausbeute, Gewichte und Anteile der Teilstücke bezogen auf den Schlachtkörper mit Hals, physikochemische Merkmale der Brustmuskeln.

Die Lebendgewichte und Schlachtkörpergewichte mit Hals waren bei den Hybriden in der 17. und in der 24. Lebenswoche signifikant geringer als bei den kommerziellen WK Gänsen (P < 0,05). Die Genotypen unterschieden sich aber nicht in der Schlachtausbeute. Der Brustmuskelanteil war bei den BxWK Gänsen in der 17. und in der 24. Lebenswoche um 6,40 bzw. 7,90 Prozentpunkte signifikant höher (P < 0,05) als bei den WK-Gänsen, während der Anteil an subkutanem Fett (8,00 bzw. 8,50%) und Abdominalfett (2,14 bzw. 2,31%) signifikant geringer war (P < 0,05). Die Brustmuskeln der Kreuzung waren signifikant (P < 0,05) heller (L*) und gelber (b*). Die Brustfleischanteil der Hybriden waren mit 17 Wochen ähnlich hoch wie mit 24 Wochen, während der Schenkelanteil signifikant höher (P < 0,05) und die Anteile an subkutanem und an Abdominalfett geringer waren (P < 0,05).

Die Interarten-Kreuzung von Kanada Gänsen mit kommerziellen Weißen Koluda Gänsen ermöglicht die Bildung von Hybriden mit einer guten Schlachtleistung, einem hohen Brustfleischanteil und einem geringen Anteil an subkutanem und Abodminalfett. Diese Schlachtkörper dürften den Verbrauchererwartungen gerecht werden. Ferner ermöglicht das Fehlen von deutlichen Geschlechtsunterschieden eine ausgewogene Leistung, die vor allem für die Verarbeitung von Vorteil sein dürfte.

Stichworte

Gans, Hybrid, Schlachtausbeute, Schlachtkörperzusammensetzung, Fleischqualität

References

Berri, C., 2000: Variability of sensory and processing qualities of poultry meat. World's Poult. Sci. J. **56**, 209-224.

Bochno, R., D. Murawska, U. Brzostowska, 2006: Age-related changes in the distribution of lean fat with skin and bones in goose carcasses. Poult. Sci. **85**, 1987-1991.

Chełmońska, B., M. Chrzanowska, E. Łukaszewicz, 1995: Comparison of body weight and zoometrical measurements of hybrids derived from reciprocal crossbreeding of Greylag and White Italian geese. Proc. 10th Eur. Symp. Waterfowl, Halle, Germany.

Chrzanowska, M., B. Chełmońska, 1997: Investigations on the reciprocal crossbreeding of White Italian and Greylag geese with the use artificial insemination method. Zesz. Nauk. Przeglądu Hod. PTZ **31**, 185-188.

Chrzanowska, M., B. Chełmońska, 2000: Certain performance traits of hybrids derived from reciprocal crossbreeding of the White Italian and Greylag geese. Zesz. Nauk. Przeglądu Hod. PTZ **49**, 119-125.

Fanatico, A.C., P.B. Pillai, J.L. Emmert, C.M. Owens, 2007: Meat quality of slow- and fast-growing chicken genotypes fed low-nutrient or standard diets and raised indoors or with outdoor access. Poult. Sci. **86**, 2245-2255.

Fletcher, D.L., 2002: Poultry meat quality. World's Poult. Sci. J. **58**, 131-145.

Grau, R., R. Hamm, 1952: Eine einfache Methode zur Bestimmung der Wasserbindung im Fleisch. Fleischwirtschaft **4**, 295-297.

Gumułka, M., D. Wojtysiak, E. Kapkowska, K. Połtowicz, A. Rabsztyn, 2009: Microstructure and technological meat quality of geese from conservation flock and commercial hybrids. Ann. Anim. Sci. **9**, 205-213.

Isguzar, E., H. Pingel, 2003: Growth, carcass composition and nutrient content of meat of different local geese in Isparta region of Turkey. Arch. Tierz. **46**, 71-76.

Kowalczyk, A., E. Łukaszewicz, 2012: The possibility of obtaining intergeneric hybrids via White Kołuda (*Anser anser* L.) goose insemination with fresh and frozen-thawed Canada goose (*Branta canadensis* L.) gander semen. Theriogenology **77**, 507-513.

Lisowski, M., A. Slawinska, P. Dluzniewska, A. Mazanowski, M. Bednarczyk, 2008: Analysis of DNA polymorphism (RAPD-PCR) and reciprocal effects of geese crossbreeds. Folia Biol. (Krakow) **56**, 159-164.

Łukaszewicz, E., M. Adamski, A. Kowalczyk, 2008: Correlations between body measurements and tissue composition of oat-fattened White Kołuda geese at 17 weeks of age. Br. Poult. Sci. **49**, 21-27.

Łukaszewicz, E., 2006: Growth rate and slaughter value of goslings obtained after geese insemination with fresh or frozen-thawed White Kołuda gander semen. J. Poult. Sci. **43**, 78-83.

Łukaszewicz, E., M. Chrzanowska, A. Jerysz, B. Chełmońska, 2004: Attempts on freezing the Greylag (*Anser anser* L.) gander semen. Anim. Reprod. Sci. **80**, 163-173.

Mazanowski, A., 2000: Rearing performance of quadruple crossbreds produced using White Kołuda and regional varieties of geese. Ann. Anim. Sci. **27**, 65-83.

Mazanowski, A., B. Chełmońska, 2000: The effects of reciprocal crossing of White Kołuda and Greylag crossbred geese with Slovakian geese. Ann. Anim. Sci. **27**, 85-103.

Mazanowski, A., Z. Bernacki, T. Kisiel, 2005: Meat traits and meat chemical composition in hybrids of Graylag (*Anser anser* L.) with White Kołuda and Slovakian geese. Anim. Sci. Pap. Rep. **23**, 15-32.

Murawska, D., R. Bochno, 2008: Age-related changes in the percentage content of carcass parts in geese. J. Cent. Eur. Agric. **9**, 211-216.

Okruszek, A., J. Książkiewicz, J. Wołoszyn, G. Haraf, A. Orkusz, G. Szukalski, 2008: Changes in selected physicochemical parameters of breast muscles of geese from Polish conservation flocks depending on duration of the post slaughter period. Arch. Tierz. **51**, 255-265.

Powell, C., 1992: The domestic duck – a preliminary investigation of eating quality. Proc. 19th WPC, Amsterdam, Netherlands.

Smith, D.P., D.L. Fletcher, R.J. Buhr, R.S. Beyer, 1993: Pekin duckling and broiler chicken pectoralis muscle structure and composition. Poult. Sci. **72**, 202-208.

Ziołecki, J., W. Doruchowski, 1989: Methods of Evaluation the Slaughter Value in Poultry. COBRD, Poznan, Poland.

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