

## CARCASS QUALITY AND PRODUCTION RESULTS OF GEESE FATTENED ON OAT FOLLOWING A RESTRICTED FEEDING REGIME

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**Key words:** geese, restricted feeding, oat fattening, carcass quality, feed consumption, feed cost.

### Abstract

The aim of this study was to determine the carcass quality and production results of geese fattened on oat following a restricted feeding regime. The experimental materials comprised White Kolumbia geese (56 ♂ and 56 ♀) reared to 15 weeks of age. During the first 12 weeks, the amount of feed given to birds was limited by 20% in comparison with the control ration, as follows: group II – from 7 to 12 weeks, group III – from 2 to 6 weeks, and group IV – from 2 to 12 weeks of age. Over the finishing period of three weeks (week 13 to 15), geese of all groups were fed oat grain *ad libitum*. At 15 weeks of age, the birds were slaughtered and carcass quality was evaluated.

Group II geese, compared with control group birds, were characterized by significantly higher body weight (6566 g vs. 6043 g), but their carcasses had a lower lean meat content (44.55% vs. 47.19%) and a higher content of skin including subcutaneous fat (36.00% vs. 32.33%). In comparison with the control group, group II geese consumed significantly less oat per kg body weight gain (9.36 kg vs. 11.56 kg) and less feed per kg body weight (3.86 kg vs. 4.31 kg), which resulted in a lower feed cost per kg body weight in group II. The lean meat content of the carcass was similar in the control group and in groups III and IV (47.19%, 45.26% and 45.13% respectively). However, group III and IV geese were characterized by significantly higher carcass fatness than control group birds (35.76%, 35.23% and 32.33% respectively), and they consumed larger amounts of feed per kg body weight. Feed cost was comparable in the above groups.

## JAKOŚĆ TUSZKI I WYNIKI ODCHOWU GĘSI DOTUCZANYCH ZIARNEM OWSA PO OKRESIE ŻYWIENIA RESTRYKCYJNEGO

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Słowa kluczowe: gęsi, restrykcyjne żywienie, dotucz owsem, wartość rzeźna, zużycie paszy, koszty paszy.

### Abstrakt

Celem podjętych badań była analiza jakości tuszki oraz wyników odchowu gęsi dotuczanych ziarnem owsa, żywionych wcześniej ograniczonymi ilościowo dawkami mieszanek przemysłowych. Badania wykonano na gęsiach Białych Kołudzkich (56 ♂ i 56 ♀) odchowywanych do wieku 15 tygodni. W okresie żywienia paszowymi mieszankami przemysłowymi (do wieku 12 tyg.) zastosowano w trzech różnych okresach wiekowych dawki żywieniowe ograniczone ilościowo o 20% w stosunku do ilości paszy pobranej przez ptaki z grupy kontrolnej (grupa I): od 7. do 12. tygodnia (grupa II), od 2. do 6 tygodnia (grupa III) oraz od 2. do 12. tygodnia (grupa IV). Następnie od 13. do 15. tygodnia odchowu gęsi ze wszystkich grup żywiono *ad libitum* ziarnem owsa. W wieku 15. tygodni ptaki poddano ubojowi i ocenie wartości rzeźnej.

Stwierdzono, że gęsi z grupy II w porównaniu z ptakami grupy kontrolnej charakteryzowała istotnie większa masa ciała (odpowiednio 6566 i 6043 g), lecz ich tuszki zawierały mniej mięsa (odpowiednio 44.55 i 47.19%), a więcej skóry z tłuszczem podskórnym (36.00 i 32.33%). Ptaki z tej grupy, w stosunku do kontrolnej, zużyły istotnie mniej owsa na 1 kg przyrostu masy ciała (9.36 i 11.56 kg) i paszy łącznie w przeliczeniu na 1 kg masy ciała (3.86 i 4.31 kg), co skutkuje mniejszymi kosztami paszy poniesionymi na uzyskanie 1 kg masy ciała. Ptaki z grup III i IV charakteryzowało podobne umięśnienie do ptaków z grupy kontrolnej (45.26; 45.13 i 47.19%), lecz istotnie większe otłuszczenie tuszki (35.76; 35.23 i 32.33%) i większe zużycie paszy przy równoczesnych podobnych kosztach paszy w przeliczeniu na 1 kg masy ciała.

### Introduction

The oat-fattened goose is one of the specialties of Polish agriculture. Due to its unique amino acid composition of protein and a high biological value, oat is an important component of diets for geese. The properties of oat were investigated in detail 80 years ago. During the finishing period of three weeks, geese are fattened on oat grain (KSIĄŻKIEWICZ 2006). The type and amount of feed determine both carcass quality and production profitability, which is why efforts are made to reduce the overall costs of goose fattening (BIELIŃSKA et al. 1984, 2002). According to BIELIŃSKA and CZECHLOWSKA (1999), an optimal solution enabling to both decrease production costs and maintain high carcass quality is to feed geese concentrate with a reduced total protein content for the first 12 weeks. The results of other studies (BIELIŃSKA et al. 1980, BOCHNO and BRZOZOWSKI 1992, JANISZEWSKA et al. 2000 and 2002, BOCHNO et al. 2007)

conducted on young slaughter geese show that temporary feed restriction, compared with *ad libitum* feeding, allows to decrease carcass fat content and to improve feed conversion efficiency. In an experiment performed by BIELIŃSKA et al. (1980), White Italian geese were given a daily ration limited by 15% from 4 to 8 weeks of age, which led to a slower growth rate and a prolonged rearing period, but had a beneficial effect on breast muscle yield and meat quality. However, more severe feed restriction (30%) caused emaciation. BOCHNO and BRZOZOWSKI (1992) limited the amount of feed offered to young slaughter geese by 20% (in comparison with *ad libitum* feeding) and reported a lower fat content of the carcass, a more desirable meat to fat ratio and lower feed consumption. The results of later studies were similar (BOCHNO et al. 2007).

The positive effects of feed restriction programs noted in young geese and a scarcity of information regarding the combination of restricted feeding and satiation feeding prompted the authors to conduct the present study, aimed to determine the carcass quality and production results of geese fattened on oat following a restricted feeding regime.

## Materials and Methods

The experimental materials comprised a total of 112 White Kolumbia geese (56 ♂ and 56 ♀) randomly divided into four feeding groups, each of two pens of males and two pens of females. The birds were reared to 15 weeks of age. During the first 12 weeks, geese were fed commercial diets, starter (to 5 weeks) and grower/finisher (from 6 to 12 weeks), containing 20.16% and 19.14% total protein and 12.34 MJ and 12.10 MJ metabolizable energy respectively. From 13 to 15 weeks of age, birds of all groups were fed *ad libitum* oat grain with a total protein content of 8.88% and a metabolizable energy content of 10.12 MJ. Over the first week of rearing, all birds were fed to appetite, and from week 2 to 12 the amount of feed offered was as follows:

- group I – continuation of *ad libitum* feeding (control);
- group II – continuation of *ad libitum* feeding until week 6, followed by feeding a ration restricted by 20% (in comparison with the control diet) until week 12;
- group III – feeding a ration restricted by 20% until week 6, followed by *ad libitum* feeding in the amount not higher than in the control group;
- group IV – feeding a ration restricted by 20% (in comparison with the control diet) from week 2 to 12.

At the completion of the rearing period, ten males and ten females were selected randomly for slaughter and post-slaughter analysis. Chilled carcasses were dissected. The collected data were used to calculate:

- feed cost (based on purchase prices of March 2008) per kg body weight,
- carcass dressing percentage as total body weight and giblets weight expressed as a percentage of live weight.

The statistical analysis (STATISTICA 8.0) included:

- the characteristics of the analyzed traits ( $\bar{x}$ ,  $v$ ),
- feed consumption per bird, feed, total protein and metabolizable energy intake per kg body weight, carcass weight and lean weight,
- the determination of the significance of differences between feeding groups with respect to the mean values of feed consumption and carcass quality; a two-factorial analysis of variance with two elements in subgroups (feed consumption and cost) or ten elements in subgroups (carcass quality parameters).

## Results and Discussion

### Body weight

During oat fattening, geese subjected previously to feed restriction (groups II–IV) were characterized by a faster growth rate than control group birds (group I). The body weight of geese of experimental groups II, III and IV increased over that period by 1355, 1098 and 1369 g respectively, compared with 647 g in the control group. Due to the above gains, the live body weight of group II and III birds before slaughter was 6566 g and 6335 g respectively, compared with 6043 g in the control group ( $p \leq 0.05$ , Table 1). The live weight of group IV geese (6109 g) was similar to the live weight of control group birds, but the former were lighter ( $p \leq 0.05$ ) than group II and III geese. Rapid weight gain following a period of feed restriction has been previously observed in chickens, turkeys (PLAVNIK and HURVITZ 1991), ducks (WILKIEWICZ-WAWRO 1994, SZEREMETA et al. 2000) and geese (BOCHNO and BRZOWSKI 1992, JANISZEWSKA et al. 2000, BOCHNO et al. 2007).

Females, compared with males, had lower body weight, which is consistent with the results of earlier studies of that species (BIELIŃSKA et al. 1980, 2002, MAZANOWSKI and BERNACKI 1998 a,b, JANISZEWSKA et al. 2000).

### Feed consumption and cost

As expected, feed consumption per bird during the first 12 weeks was highest in the control group (21.73 kg) and lowest in group IV (18.05 kg). Feed intake was lower in group II than in group III (18.57 kg vs. 20.66 kg).

Table 1

Body weight of geese, feed consumption and cost

Specification	Statistical measures	Group				Sex	
		I	II	III	IV	♂	♀
Body weight (g) at the age of:							
12 weeks	$\bar{x}$	5396 <sup>A</sup>	5209 <sup>A</sup>	5237 <sup>A</sup>	4740 <sup>B</sup>	5302*	5030
	$v$	12.71	9.69	8.92	9.63	11.94	10.14
15 weeks	$\bar{x}$	6043 <sup>a</sup>	6566 <sup>b</sup>	6335 <sup>b</sup>	6109 <sup>a</sup>	6506*	6036
	$v$	14.63	11.41	11.55	10.52	11.93	11.46
Feed consumption [kg/bird]	$\bar{x}$	21.73 <sup>A</sup>	18.57 <sup>Ba</sup>	20.66 <sup>A</sup>	18.05 <sup>Bb</sup>	20.15*	19.34
Feed and oat consumption [kg/bird]	$\bar{x}$	32.53	31.35	33.01	32.11	32.56	31.85
Oat consumption [kg] per kg body weight gain between week 13 and 15	$\bar{x}$	11.56 <sup>a</sup>	9.36 <sup>b</sup>	10.39 <sup>ab</sup>	9.32 <sup>b</sup>	9.80	10.37
Total feed and oat consumption [kg] per kg body weight gain	$\bar{x}$	4.40 <sup>A</sup>	3.96 <sup>B</sup>	4.81 <sup>C</sup>	4.76 <sup>C</sup>	4.43	4.55*
Feed cost [PLN] per kg body weight	$\bar{x}$	5.23 <sup>A</sup>	4.48 <sup>B</sup>	5.35 <sup>A</sup>	5.20 <sup>A</sup>	5.01	5.12*

Means followed by different superscript letters (feeding groups) or by\* (sex) are significantly different: capital letters or \*\* - at  $\alpha = 0.01$ , small letters or \* - at  $\alpha = 0.05$ .

Restricted feeding, in comparison with *ad libitum* feeding, affected not only the final body weight of geese aged 15 weeks, but also oat consumption and conversion levels. It should be stressed that birds of experimental groups were more efficient users of oat grain. Oat consumption per kg body weight gain was significantly lower in groups II and IV (9.36 and 9.32 kg respectively) than in the control group (11.56 kg, Table 1). Group III geese consumed less oat (10.39 kg, Table 1) than control group geese, but more than birds of the remaining groups. The above indicates that feed restriction from week 2 or 6 to 12 has a beneficial influence on oat intake. Significant differences were also noted with respect to total feed consumption per kg body weight gain over the entire experiment. The lowest feed conversion ratio was reported in group II (3.96 kg kg<sup>-1</sup>), and highest – in groups III and IV (4.8 kg kg<sup>-1</sup>), compared with 4.40 kg kg<sup>-1</sup> in the control group.

Feed cost per kg body weight was significantly lower in group II (PLN 4.48) than in the control group (PLN 5.23) and in the remaining experimental groups (above PLN 5.20, Table 1). The total cost of feed consumed in groups III and IV reached 102.3% and 99.4%, respectively, of that noted in the control group. Those results suggest that feeding geese aged 7 to 12 weeks a ration reduced by 20%, in comparison with the control diet, may contribute to a significant decrease in the overall production costs of oat-fattened geese.

Feed consumption per kg body weight, depending on feeding levels at different rearing stages (Table 2), was similar to feed consumption per kg body

weight gain (Table 1). Over the entire experiment, group II geese consumed by approximately 12% less feed per kg body weight than birds of the remaining groups. Feed consumption per kg carcass weight was significantly lower in group II (6.42 kg) than in the control group (7.29 kg) and in groups III and IV (above 7.54 kg). A similar trend was observed with regard to feed consumption per kg lean meat weight.

Table 2  
Feed [kg], total protein [g] and metabolizable energy [MJ] intake per kg body weight, carcass weight and lean weight

Specification	Group				Sex	
	I	II	III	IV	♂	♀
Feed intake [kg] per kg:						
body weight	4.31 <sup>A</sup>	3.86 <sup>B</sup>	4.71 <sup>C</sup>	4.66 <sup>C</sup>	4.34	4.45*
carcass weight	7.29 <sup>b</sup>	6.42 <sup>a</sup>	7.54 <sup>b</sup>	7.56 <sup>b</sup>	7.17	7.23
lean meat weight	15.86 <sup>ABa</sup>	14.82 <sup>Aa</sup>	17.13 <sup>Bb</sup>	17.09 <sup>Bb</sup>	16.19	16.32
Total protein intake [g] per kg:						
body weight	779.9 <sup>AB</sup>	664.4 <sup>B</sup>	802.4 <sup>Aa</sup>	770.4 <sup>Ab</sup>	746.6	759.4
carcass weight	1314.8 <sup>B</sup>	1103.7 <sup>Aa</sup>	1284.1 <sup>Bb</sup>	1249.5 <sup>b</sup>	1234.4	231.2
lean meat weight	2859.5 <sup>A</sup>	2548.9 <sup>Bb</sup>	2916.2 <sup>A</sup>	2823.5 <sup>a</sup>	2785.0	2779.0
Metabolizable energy intake [MJ] per kg:						
body weight	51.1 <sup>A</sup>	45.4 <sup>B</sup>	54.5 <sup>A</sup>	53.6 <sup>A</sup>	51.0	51.3
carcass weight	86.1 <sup>a</sup>	75.4 <sup>b</sup>	87.3 <sup>a</sup>	86.9 <sup>a</sup>	84.2	83.3
lean weight	187.3 <sup>AB</sup>	171.1 <sup>A</sup>	198.2 <sup>B</sup>	196.5 <sup>B</sup>	190.1	188.0

Means followed by different superscript letters (feeding groups) or by\* (sex) are significantly different: capital letters or \*\* - at  $\alpha = 0.01$ , small letters or \* - at  $\alpha = 0.05$ .

Total protein and metabolizable energy intake per kg body weight, carcass weight and lean meat weight was also lower in group II than in the control group and in groups III and IV (Table 2). Total protein and metabolizable energy intake per kg body weight was by respectively 116 g and 5.7 MJ lower in group II than in the control group. Compared with the control group, group II geese needed also less protein (by 311 g) and metabolizable energy (by 16 MJ) to produce 1 kg lean meat.

### Carcass quality

At the end of the oat fattening period, the average carcass weight of geese subjected to early feed restriction was slightly higher ( $\geq 3834$  g) than the carcass weight of control group birds (3613 g, Table 3). The weights of abdominal fat, gizzard and liver were also higher in experimental groups.

Heart weight was significantly ( $p \leq 0.05$ ) higher in group II than in group I. Carcass dressing percentage was similar in all groups (from 68.63% to 69.04%).

Table 3

Carcass quality parameters (arithmetic means and coefficients of variation)

Specification	Statistical measures	Group				Sex	
		I	II	III	IV	♂	♀
Carcass weight [g]: hot	$\bar{x}$	3613	3899	3961	3834	3938	3710
	$v$	13.27	9.81	8.95	12.43	12.44	9.97
cold	$\bar{x}$	3547	3812	3885	3762	3851	3646
	$v$	13.43	9.10	9.04	12.56	12.37	10.12
Carcass dressing percentage (%)	$\bar{x}$	68.50	68.63	68.92	69.04	68.56	68.94
	$v$	2.98	3.15	2.14	2.61	3.09	2.30
Total giblets weight including: [g]	$\bar{x}$	335.6	383.7	368.7	367.9	387.3	340.5
	$v$	13.96	12.62	11.17	15.21	13.34	11.14
liver	$\bar{x}$	90.6	107.9	112.2	109.0	111.9	97.7
	$v$	27.15	17.40	27.75	24.29	28.35	20.12
heart	$\bar{x}$	36.6 <sup>a</sup>	43.6 <sup>b</sup>	41.1	38.2	41.6	37.9
	$v$	21.01	16.65	17.76	13.38	17.45	18.18**
gizzard	$\bar{x}$	208.4	232.2	215.4	220.8	233.9	204.9
	$v$	14.97	16.19	10.56	16.27	14.36	11.99
Abdominal fat weight [g]:	$\bar{x}$	291.0	332.9	333.2	308.8	309.2	319.5
	$v$	30.32	30.57	23.33	27.11	31.15	24.86
Relative weight of carcass lean meat	$\bar{x}$	1667	1694	1755	1691	1749	1660
	$v$	10.53	8.40	8.51	10.77	9.08	9.50
skin and subcutaneous fat	$\bar{x}$	1159 <sup>a</sup>	1377 <sup>b</sup>	1392 <sup>b</sup>	1330	1329	1285
	$v$	23.61	16.56	14.18	18.19	21.55	17.17**
bones	$\bar{x}$	561	570	562	554	595	533
	$v$	10.06	14.18	11.05	16.73	12.52	10.39
Percentage content in carcass lean meat	$\bar{x}$	47.19 <sup>a</sup>	44.55 <sup>b</sup>	45.26	45.13	45.67	45.62
	$v$	5.55	5.92	5.85	6.60	6.69	5.90
skin and subcutaneous fat	$\bar{x}$	32.33 <sup>a</sup>	36.00 <sup>b</sup>	35.76 <sup>b</sup>	35.23 <sup>b</sup>	34.20	35.08
	$v$	11.45	11.48	8.25	10.27	11.96	10.25
bones	$\bar{x}$	15.93 <sup>a</sup>	14.96	14.45 <sup>b</sup>	14.71 <sup>b</sup>	15.50*	14.67
	$v$	9.72	10.82	5.97	9.11	9.53	9.17

Means followed by different superscript letters (feeding groups) or by\* (sex) are significantly different: capital letters or \*\* - at  $\alpha = 0.01$ , small letters or \* - at  $\alpha = 0.05$ .

Feeding geese a restricted ration prior to oat fattening resulted in significant differences in carcass tissue composition, compared with *ad libitum* feeding. The carcasses of group II geese, in comparison with group I birds, had a similar content of lean meat (1694 g vs. 1667g) and bones (570 g vs. 561 g), but a higher content of skin and subcutaneous fat (1377 g vs. 1159 g,  $p \leq 0.05$ ). The percentage share of skin and subcutaneous fat was higher (by 3.67%), and that of lean meat lower (by 2.64%, Table 3) in group II. The carcasses of group III geese, compared with group I birds, had a similar percentage content of lean

meat (45.26% vs. 47.19%), but a higher percentage share of skin and subcutaneous fat (35.76 vs. 32.33%, Table 3). The carcasses of group IV geese, in comparison with the control group, had a similar content of lean meat, but a higher (by 2.9%) percentage share of skin and subcutaneous fat and a lower (by 1.22%) bone content ( $p \leq 0.05$ , Table 3).

Females, in comparison with males, had somewhat lower carcass weight as well as a lower content of the analyzed tissue components and insignificantly higher abdominal fat weight, which is consistent with the findings of other authors (BIELIŃSKA et al. 2002, MAZANOWSKI and BERNACKI 1998 b).

## Conclusions

1. Group II geese (fed a restricted ration from week 7 to 12, prior to oat fattening), compared with control group birds, were characterized by significantly higher body weight (6566 g vs. 6043 g), but their carcasses had a lower lean meat content (44.55% vs. 47.19%) and a higher content of skin including subcutaneous fat (36.00% vs. 32.33%). In comparison with the control group, group II geese consumed significantly less oat per kg body weight gain (9.36 kg vs. 11.56 kg) and less feed per kg body weight (3.86 kg vs. 4.31 kg), which resulted in a lower feed cost per kg body weight. Total protein and metabolizable energy intake per kg body weight, carcass weight and lean weight was also lower in group II than in the control group.

2. The body weight and carcass tissue composition of group III geese (fed a restricted ration from week 2 to 6, prior to oat fattening) and group II birds were similar, but the former were characterized by significantly higher levels of total oat and feed consumption per kg body weight gain and higher intake of total protein and metabolizable energy. Feed cost per kg body weight was highest in group III.

3. The body weight and carcass lean meat content of group IV geese (fed a restricted ration from week 2 to 12, prior to oat fattening) and group I birds were similar (6109 g and 6043 g respectively and 45.13% and 47.19% respectively), but the former had a higher carcass fat content (35.23% vs. 32.33%). Total feed consumption was higher in group IV (4.76 kg vs. 4.40 kg), while feed cost per kg body weight was comparable in both groups.

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