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FINISHING PERFORMANCE OF WHITE IMPROVED BILLY GOATS

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ABSTRACT

The study was aimed to determine an effect of various feed mixes on finishing White Improved billies reared until 6 months of age. The experiment was carried out in three replications. The study focused on the following sets of traits: body weight gain, feed consumption per weight gain, carcass and half-carcass measurements, slaughter performance and carcass tissue composition. The experiment has shown that farm-made balanced diets, which have a slightly lower level of protein but are richer in fibre, can be successfully used in feeding finishing White Improved billies. Namely, animals fed on this diet, although showing some performance parameters slightly reduced, achieved their slaughter value and meat quality similar to those fed on commercial “CJ” feed.

Key words: billy goats, feed use, daily gains, slaughter performance

INTRODUCTION

Most goat farms in Poland are oriented on dairy production. Dairy goat breeders face the problem of proper utilisation of billy goats that are born on the farm; producing young slaughter goats would represent a solution for this. However, a goat meat market should be organized in Poland for the purpose. Due to a lack of tradition, consumption of goat meat in Poland is very limited, and so is the demand; the output, however, could be exported to the very demanding though the largest potential goat meat market that located in the European Union, or to a range of Middle-Eastern and Mediterranean countries [5, 13]. To date, no quotas have been levied on goat products exported to the EU and such products can be very competitive in relation to those produced within the developed countries.

The aim of this study was to to determine an effect of two feeds (farm-made mix and commercial feed) on finishing performance of White Improved billies reared until 6 months of age.

MATERIALS AND METHODS

The experiment was carried out in three replications. The material consisted of White Improved billy goats, which had been obtained from a herd of 90 dam-goats. The births fell within the period January-February. The billies were nursed by the dams until 60 days of age. After the weaning, the billies were randomly chosen from the groups of single births and twin births, 50% from each group.

In each replication the animals were divided into two groups (A and B) and housed indoors.

Group A was fed on acquired commercial *CJ* feed; group B was fed on *W* balanced ration containing: 40% ground oats, 14% ground barley, 15% ground soya, 30% wheat bran, 1% *Mikrofos*, which had been an on-farm production basing on own feeds obtained from the region of Podlasie (except for soya).

Finishing of the experimental billies lasted from 60 days until 6 months of age. During this period, the animals were *ad libitum* fed on balanced ration as well as on middle-class meadow hay, as a structural supplement to the fed balance ration. The amount of fed ration remained under permanent monitoring and, once a week, the amount of uneaten feed was measured.

Each year the feeds were analysed using conventional methods (Table 1).

Table 1. Nutritive value compounds

Sort of feed	Years	Dry matter (%)	Crude fibre (%)	Crude potein (%)
"CJ" Feed	1	88.8	5.02	17.3
	2	89.1	6.00	18.4
	3	88.0	5.37	18.8
	$\overline{x}$	88.6	5.46	18.2
"W" Feed	1	88.2	5.55	15.6
	2	88.0	5.83	16.5
	3	88.0	6.21	16.0
	$\overline{x}$	88.1	5.86	16.0

Basing on feed composition and digestibility of individual components, net energy (NE) content was calculated (Polish Standards: Calculating nutritional value of feeds constituting feed mixes, PN-75/R-64790). The *CJ* feed contained 5.63 MJ of net energy, while the *W* feed had 5.4 MJ of net energy. Feed and nutrient consumption was evaluated per 1 kg body weight gain of the goats by group. At the age of about 2 month, the animals were subjected to "bloody" castration, which was performed by a veterinarian in the sheds where finishing was carried out. On finishing completion, the animals were slaughtered. All the handling related to slaughter, measurements and post-slaughter evaluation was carried according methodology by the Animal Husbandry Institute [7]. The results were processed statistically and mean values (x) as well as standard deviations (S) have been presented in the Tables for each individual trait. Statistical analysis consisted of ANOVA for double non-orthogonal crossed classification, including effects of the year of experiment and feeding group. The SPSS PC software package was used for the analyses [6].

RESULTS AND DISCUSSION

The results of finishing of the billy goats have been presented in Table 2. Body weight at birth in both feeding groups, as well as in subsequent years of the experiment, was similar. During the maternal nursing until 60 days of age, no significant differences were found between the feeding groups, while statistically highly- significant differences were found between the subsequent years of the study. Higher body weight at the end of finishing were shown by the billies that had been fed on the commercial *CJ* feed (35.13 kg) compared with those fed on the farm-made feed (32.76 kg), and these differences were confirmed statistically. Daily weight gains during the finishing, i.e. from 60 days until 6 months of age, were higher in the group fed on the *CJ* feed (163 g) compared with those fed on the farm feed (149 g) and the differences demonstrated proved to be significant at $p < 0.05$. An

analysis of the results of individual years showed that the lowest body weight on 60 days and on completion of the finishing, as well as body weight gains, were found in the first year of the studies compared with the two subsequent years ($p < 0.05$).

The results of this study are difficult to compare with the results reported by other authors, as either 16-kg billies were evaluated [13, 14] or interracial crossbreds [16]. Only the results published by Pawlina et al. [9], who analysed body weight and daily weight gains of White Improved billy goats until 6 months of age, can be partially compared with our results. The authors found that 6-month-old billies from single births were characterised by a higher mean body weight, 35 kg, that those born in twin birth (27 kg), whereas daily gains during the period from birth until 6 months of age were 170 g and 133 g in, respectively, single-births and twins.

Feed consumption per 1 kg body weight represents an important index for evaluation of finishing efficacy. The data presented in Table 2 demonstrate that the billies fed on the farm feed consumed by 0.32 kg more feed in relation to those fed in the *CJ* feed. The higher consumption of feed in this group may be associated with the fact that the diet fed to the animals contained slightly less protein.

Table 2. Results of goat fattening experiment

Specification		Feeding group		Years		
		A (n=25)	B (n=25)	I (n=18)	II (n=16)	III (n=16)
Body weight (kg)						
at 2 days	$\bar{x}$ S	3.48 0.24	3.60 0.21	3.40 0.28	3.53 0.21	3.68 0.26
at 60 days of age	 S	15.57 2.17	14.90 2.56	13.37^{A} 2.28	16.00^{B} 1.46	16.33^{B} 2.24
at the end	$\bar{x}$ S	35.13^{*} 3.84	32.76^{*} 2.69	29.19^{A} 2.33	36.83^{B} 2.95	35.82^{B} 3.64
Daily weight gain during finishening ($g\ day^{-1}$)	$\bar{x}$ S	163^{*} 1.75	149^{*} 2.11	133^{A} 1.06	174^{B} 1.13	162^{B} 1.08
Consumption per 1 kg gain						
fibre (kg)	$\bar{x}$	5.08	5.40	5.61	5.03	5.12
crude protein (g)	$\bar{x}$	924.60	832.00	894.80	852.60	890.90
net energy (MJ)	$\bar{x}$	28.60	30.90	31.90	28.60	29.10

$\bar{x}$ – Mean arithmetical,
S – Standard deviation,
a,b,c - $p \leq 0.05$; A,B,C - $p \leq 0.01$ for years experiment,
* $p \leq 0.05$; $p \leq 0.01$ for group feeding.

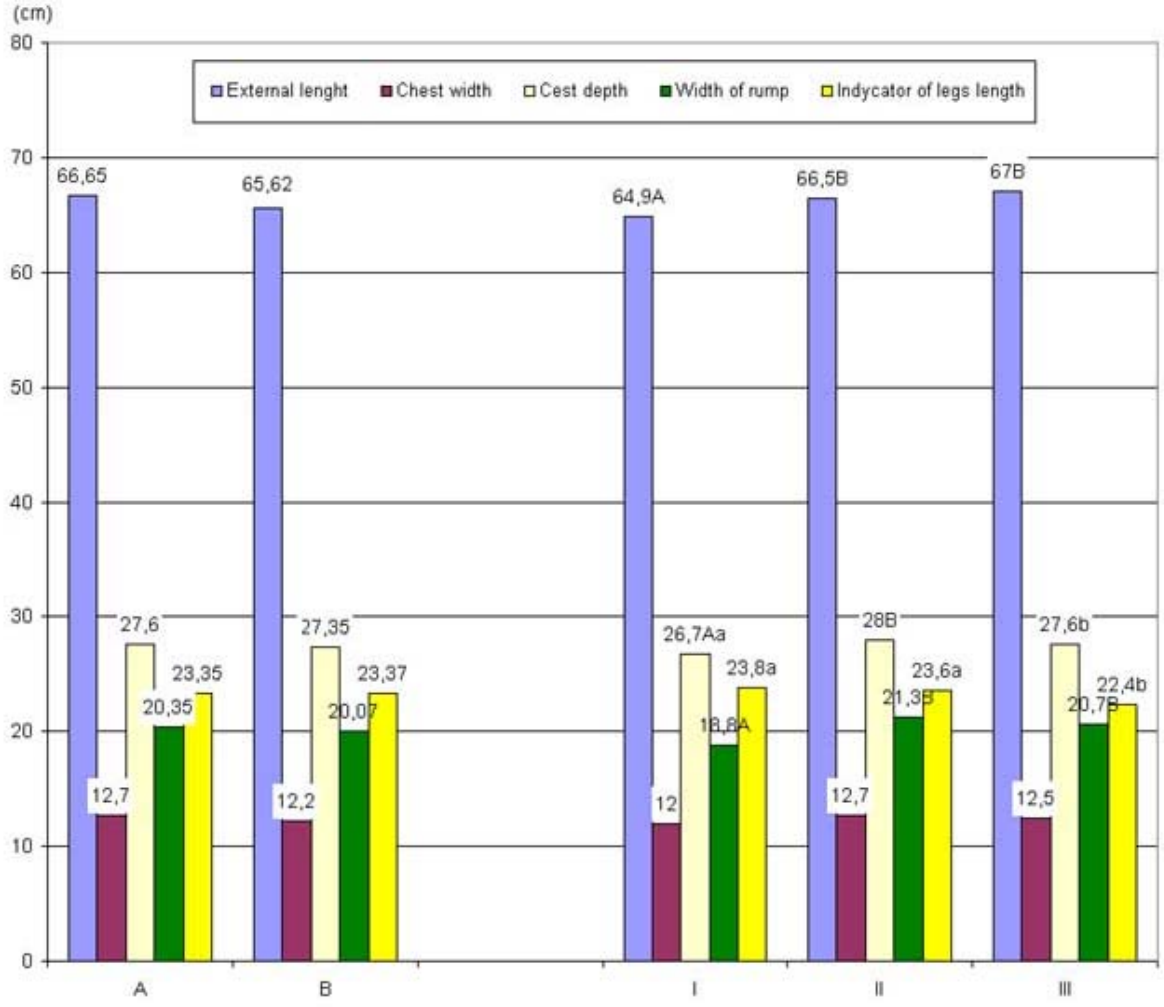
Evaluation of the effect of years revealed that the best finishing performance was achieved in the second year of the experiment, which is shown by the higher body weight on the completion of finishing (36.83 kg), higher daily gains (174 g), with a lower consumption of the balance ration (5.03 kg) as well as protein and energy per body weight gain unit. Surprisingly poor finishing performance were found in the first year of the studies. Probably, this resulted from strong variation of temperature during the first year of the experiment when the observations took place, which did not occur in the subsequent two years. Despite the fact that body weights at birth of the studied animals in individual years of the experiment were similar, the temperature variations recorded during the first year of the studies resulted in reduced body weight (13.37 kg) at 60 days of age, as compared with the results obtained in the two subsequent years, as well as the lowest daily gains and the higher feed consumption until the end of the experiment. At the same time, Table 4 presents hat the billy goats from the first year of the experiment had the lowest carcass fat content, the lowest lean content in half-carcass and leg, despite the fact the percentage of lean in those cuts was similar between the years of the studies. Sanz-Sampelayo et al. [18] proved a significant effect of temperature and environment on finishing performance including influence on body weight and energy consumed in goats and sheep. Similar associations may be found in the results of the presented experiment.

In the Polish animal husbandry literature, there are no reports on the consumption level of nutritive components during billy goat finishing, therefore comparisons were done in relation to lambs finished in a similar system [1, 15]. Our results have shown that the billies used less feed and feed nutritive components per 1 kg body weight

gain than lambs. Lower energy requirement of goats compared with lambs was demonstrated by Panaretto and Till [8], Jagush et al. [2], and Sanz-Sampelayo et al. [17].

Figure 1 presents linear measurements of carcasses, while data on half-carcasses have been presented in Table 3. In either group of the examined billies, no statistically significant differences were found in carcass measurements. The carcasses of the *CJ*-fed billy goats were longer and had wider and deeper chests compared with those of the goats fed on the farm feed. A comparison of the years of the experiment has revealed statistically significant differences, except for chest width.

Fig. 1. Linear measurements of goat carcass



A,B,... p≤0.01; a,b,... p≤ 0.05.

Table 3. Linear measurments of goat carcass (cm)

Specyfication		Group feeding		Years		
		A (n=25)	B (n=25)	I (n=18)	II (n=16)	III (n=16)
Central length	$\overline{X}$	64.50	63.80	62.60^{A}	64.80^{B}	64.90^{B}
	S	2.72	2.71	1.19	1.22	1.25
Front width I	$\overline{X}$	23.47	23.57	22.80^{a}	23.60^{b}	23.80^{b}
	S	3.41	1.57	1.28	1.70	1.75
Front width II	$\overline{X}$	24.77	24.50	24.50	24.80	24.70
	S	2.25	1.66	1.32	1.43	1.60
Front width III	$\overline{X}$	26.25	25.80	25.80	26.20	26.00
	S	2.03	1.73	2.20	1.67	1.70
Length of leg	$\overline{X}$	35.95^{*}	33.00^{*}	31.10^{A}	36.70^{B}	35.70^{B}
	S	3.46	4.22	2.24	2.27	1.7
Circumference of leg	$\overline{X}$	33.95	34.10	32.50^{A}	33.50^{A}	35.10^{B}
	S	3.17	3.00	2.82	2.17	2.55
Length of tibia	$\overline{X}$	21.25	20.45	20.20^{A}	21.50^{B}	21.00^{B}
	S	3.06	1.60	2.34	1.74	1.89
Length of perineum	$\overline{X}$	7.80	7.48	7.60	7.80	7.75
	S	0.84	0.82	0.68	1.05	0.87
Length of loin	$\overline{X}$	31.50^{*}	30.55^{*}	29.30^{A}	32.50^{B}	31.30^{B}
	S	1.24	2.70	2.34	2.27	1.75
Womb circumference	$\overline{X}$	35.35^{*}	33.95^{*}	32.70^{A}	36.60^{B}	36.20^{B}
	S	2.14	2.93	2.58	1.97	1.50

Symbols as in Table 2.

Table 4. Carcass and leg tissue composition in goats

Specification		Feeding group		Years		
		A (n=25)	B (n=25)	I (n=18)	II (n=16)	III (n=16)
Slaughter efficiency (%)	$\overline{X}$	48.50	48.02	46.23^{A}	49.35^{B}	48.77^{B}
	S	1.73	2.52	2.33	1.23	1.36
Half-carcass						
- muscles (kg)	$\overline{X}$	4.89	4.35	3.76^{A}	5.09^{B}	5.04^{B}
	S	1.15	1.05	1.25	1.32	1.10
(%)	$\overline{X}$	59.87	58.89	59.02	59.46	59.67
	S	2.78	2.71	3.17	1.74	3.16
- fat (kg)	$\overline{X}$	1.40	1.36	1.10	1.51	1.60
	S	0.90	0.86	0.88	0.84	0.85
(%)	$\overline{X}$	17.20	18.39	17.34^{A}	17.30^{A}	18.91^{B}
	S	1.12	1.48	1.45	0.77	1.37
- bones (kg)	$\overline{X}$	1.87	1.68	1.51	2.02	1.81
	S	2.11	2.85	1.94	2.01	2.64
(%)	$\overline{X}$	22.93	22.72	23.64	23.14	21.42
	S	2.68	3.01	2.32	1.89	3.76
Leg:						
- muscles (kg)	$\overline{X}$	1.362	1.159	1.039^{A}	1.440^{B}	1.391^{B}
	S	0.23	0.29	0.27	0.22	0.15
(%)	$\overline{X}$	70.13	70.32	69.58	70.07	70.45
	S	1.70	1.57	1.61	1.28	1.39
- fat (kg)	$\overline{X}$	0.271	0.224	0.212^{Aa}	0.270^{b}	0.287^{B}
	S	0.06	0.07	0.06	0.05	0.07
(%)	$\overline{X}$	13.95	13.59	14.20^{b}	13.14^{a}	14.54^{b}
	S	1.74	1.82	1.21	1.23	2.55
- bones (kg)	$\overline{X}$	0.309^{*}	0.265^{*}	0.242^{Aa}	0.345^{B}	0.296^{b}
	S	0.07	0.06	0.06	0.05	0.05
(%)	$\overline{X}$	15.91	16.08	16.21^{a}	16.79^{a}	14.99^{b}
	S	1.90	1.26	1.47	0.79	2.33

Symbols as in Table 2.

Measurements of the half-carcasses were similar in both experimental groups. The only significant differences between the means of the groups were found for such measurements as: leg length, loin length and circumference at pubic symphysis. The goat half-carcasses measurements in the first year of the study, as compared with those in the two following years, were characterised by lower levels of the analysed traits – differences statistically significant or highly significant.

A lack of comparable literature data makes it impossible to discuss the results obtained. However, a comparison of our results with those measured on lambs slaughtered at a similar age and of a similar body weight [1, 10, 15] has revealed that goat carcasses are longer and narrower in the chest than lamb carcasses.

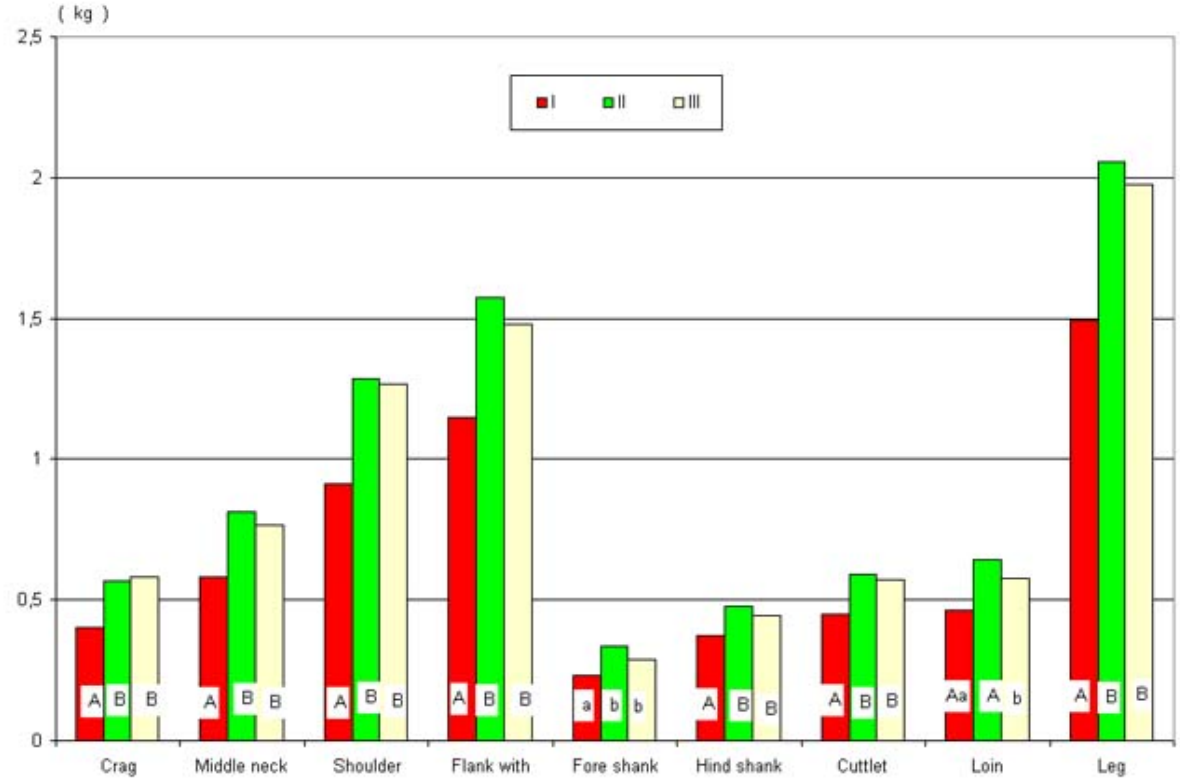
Figures 2 and 3 present the results referring to the weights of individual cuts of the right half-carcass. An analysis of these data allows concluding that cut weights in a vast majority of half-carcasses were similar in both experimental groups. Leg weights of the goats fed on *CJ* feed (1.942 kg) were statistically significantly higher compared to those of the billies fed on the farm feed, which reached 1.648 kg. Statistically highly significant differences were also found for rear shin weight and prime cuts.

Differences in cut weight between the replications were statistically significant or highly significant and resulted primarily from lower weights of goat carcasses in the first replication.

Fig. 2. Weight cuts half-carcass by feeding group

A,B,... p≤0.01; a,b,... p≤ 0.05.

Fig. 3. Weight half-carcass cuts by years



A,B,... p≤0.01; a,b,... p≤ 0.05.

Slaughter performance index represents one of the most important parameter that describes post-slaughter value of an animal. This is the trait that to a large extent determines whether the production will be profitable or not, especially in the case of live animal purchase. An analysis of the data presented in Table 4 allowed concluding that the highest index of slaughter performance were achieved by the billies in the second year of the studies (49.35%), while the lowest in the first year (46.23%). ANOVA confirmed statistically significant difference in the indices of slaughter performance of the billies between the analysed years of the studies.

In Polish literature on animal husbandry there is little data on slaughter performance of White Improved billy goats finished for a higher body weight [4, 5, 19]. Certain indices of the slaughter performance reported by these authors were lower (40.90, 41.05, and 44.45%) that those obtained in this study.

Tissue composition is one of the more important measures of carcass quality. A data analysis (Table 4) allows concluding that mean muscle tissue mass, as well as mean percentage of these elements in half-carcass was similar in both groups, and the differences between the means of the groups were low and statistically non-significant. The half-carcasses of the goats fed on *CJ* feed showed slightly higher lean (by 0.88%) and bone content (by 0.21%), while containing slightly less fat (by 0.21%), compared with those fed on the farm feed. Krupa [5] found a lower lean percentage (56.45%), higher bone content (19.31%), and a similar content of fat (22.19%), in the billy goats slaughtered at 33 kg of body weight.

An analysis of the effect of the years revealed statistically highly significant differences for lean weight and percentage fat content in half-carcass. For the remaining traits, no differences between years have been found.

Literature data [1, 3,11,15] demonstrate that similar morphological composition of half-carcass have been found in lambs of meat-wool breeds, since muscle tissue content reaches 54-65%, fat tissue 15-22%, bone tissue about 19-24%. The percentage shares of lean and fat in goat legs in both experimental groups was very similar and reached: 70.13 and 70.32% for lean and 13.95 and 13.59% for fat. Significantly higher values were found for bone weight (0.309kg) in legs of *CJ*-fed billies compared to those fed on the farm feed (0.265 kg).

Differences between the mass of individual tissues in the leg (Table 4) between the years of the studies were varied and statistically highly significant, which mainly resulted from higher weight of the leg in the second

replication. No significant differences were found the lean percentage in the leg between the replications. Statistically significant differences were demonstrated, however, for bone and fat percentage content in the leg. In the second replication, lower fat content was found (13.14%), while higher content of bone (16.79%), in relation to the first and third replications.

A slightly lower value of the leg tissue composition in the goats slaughtered at the weight of 33 kg from those found in our studies was also reported by Krupa [5], who demonstrated that muscle tissue of the leg represented 69.10%, bone tissue 17.30%, and fat tissue represented 13.50% of the mass.

In the studies described by Gruszecki [1], Kędzior [3], and Rogorzyński [15], which covered lambs of comparable age and of similar pre-slaughter body weight, a similar leg composition was found, i.e. lean percentage was 71-74%, bone 14-17%, and fat 8.13%.

CONCLUSIONS

The studies indicate that balanced feeds produced on our farm can be successfully used in finishing of White Improved billies. Namely, the animals fed on such feeds (which have a slightly lower level of protein with a higher content of fibre) achieved slightly worse production indices, however their general slaughter performance and meat quality did not differ from the billies finished on the commercial *CJ* feed.

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