

Effect of pre-slaughter body weight of fatteners on their slaughter value

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Abstract: *Effect of pre-slaughter body weight of fatteners on their slaughter value.* Fattening of 79 three-breed pigs (Polish Landrace × White Polish Large) × Duroc was carried out. The animals were kept and fed in the standardized way. The research material was assigned to two experimental groups; the criterion for classification was body weight before slaughter (group A ≤100 kg, group B >100 kg; difference 15 kg; $P \leq 0.001$). After slaughter, the loin “eye” height, backfat thickness and carcass meatiness were instrumentally determined by the EUROP system. Also, the tests concerning the quantity of LL muscle were performed, by determination of colour ($L^*a^*b^*$), water holding capacity (WHC) and free drip. Chemical composition of LL muscle samples were determined, including: content of dry matter, total protein, intramuscular fat, crude ash, as well as participation of fatty acid groups: SFA, MUFA, PUFA n-6, PUFA n-3. The ratio of acids: n-6 to n-3, MUFA to UFA, MUFA to SFA and PUFA to SFA, was determined. The pre-slaughter body weight affected the few slaughter and meat qualities. The carcasses obtained from lighter pigs were a by lower fattening, with the preservation of good meatiness. The content of intramuscular fat was higher in the samples of meat from the fatteners of group A as compared to the experimental group B ($P \leq 0.05$). Any significant effect of body weight on the remaining chemical traits and the participation of fatty acid groups in the examined samples of LL muscle were not found.

Key words: fatteners, pre-slaughter body weight, quantity and quality of meat

INTRODUCTION

Slaughter value of raw material is determined by its technological value, i.e. dressing performance, meatiness of carcass, participation of valuable cuts and their tissue composition as well as chemical composition. Producer, processor and consumer expect good meatiness and quality of carcasses. The quality of raw material is, however, determined by many factors. Apart from breed and gender of animal and nutrition (Čandek-Potokar et al. 1998, Grześkowiak 1999), they include body weight (Łyczyński et al. 2000, Sládek et al. 2004) and age at slaughter (Migdał et al. 2007). The carcasses obtained from the fatteners, differing in the mentioned parameters are different in respect of quality although not all tests indicate the existence of the same dependencies of the traits (Weatherup et al. 1998, Latorre et al. 2004, Strzelecki et al. 2008, Sieczkowska et al. 2009, Zybert et al. 2015). The meat industry prefers slaughter of heavier fatteners (Sieczkowska et al. 2008) in spite of the fact that the lighter animals are characterized by higher degree of meatiness (Łyczyński et al. 2000, Zybert et

al. 2001, Gardzińska et al. 2002). It results from economical calculation, better quality parameters and greater commercial attractiveness of the obtained carcasses (Krzącio et al. 2004, Latorre et al. 2004, Zybert et al. 2005).

The aim of the conducted studies was to determine the effect of pre-slaughter body weight on the selected slaughter traits of fatteners and on meat quality.

MATERIAL AND METHODS

The experiment included 79 three-breed hybrid pigs (Polish Landrace × White Polish Large) × Duroc, kept in the uniform management conditions and *ad libitum* fed the full-ration mixtures. The animals covered with the experiment were maintained in the rooms, satisfying zoo-technical and zoo-hygienic standards (Regulation of the Ministry of Agriculture and Rural Development, Dz.U. 2010 nr 56, poz. 344).

After completion of three-stage fattening, the slaughter of the animals was carried out (winter period) in accordance with the procedures, binding in the meat industry, with the application of electric method of stunning (Regulation of the Ministry of Agriculture and Rural Development, Dz.U. 2004 nr 205, poz. 2102). The height of the loin “eye”, thickness of backfat and meatiness were evaluated, using optical-needle CGM, admitted to use in Poland (EUROP system).

After 24-h cooling down at temperature of +4°C, the samples of *M. longissimus dorsi* from left semi-carcasses were collected for further studies.

The results obtained for the slaughtered fatteners were classified and ana-

lyzed according criterion of pre-slaughter body weight. The following body weight (*BW*) of the fatteners was adopted: group A ≤100 kg and group B >100 kg (difference 15 kg; $P \leq 0.001$).

The examination of meat colour, water-holding capacity (WHC) and a free drip was carried out. The measurement of parameters of meat colour were performed in system CIE L*a*b*, using Chroma Meter CR-400/410 – Konica Minolta. The procedure for determination of meat colour consisted in sampling a slice of muscle of about 2-cm thickness and performing three measurements in different points (the result was averaged). The determination of water-holding capacity was carried out by the method of Grau and Hamm (1952), modified by Pohja and Ninivaara (1957). To determine the quantity of free drip, the meat sample of about 300 g was placed in polyethylene bag and stored under the refrigeration conditions (+4°C) for 24 h. After the said time, the drip as being expressed in percentage in relation to the weight of the sample before the storage was assessed (Prange et al. 1977).

The following chemical composition of the meat was determined: content of dry matter, total protein, intramuscular fat and crude ash (AOAC 1990). In the lipid fraction of the meat, the groups of fatty acids were determined: SFA, MUFA, PUFA n-6, PUFA n-3, and also n-6/n-3, MUFA/PUFA, MUFA/SFA and PUFA/SFA. The preparation and analysis of methyl esters of fatty acids in lipid fraction of LL muscle was carried out by gas chromatography in accordance with the standard (EN-ISO 5508, EN-ISO 5509) – gas chromatograph Hewlett Packard 6890 Series GC System

– (PN-ISO 5508:1996, PN-ISO 5509:2001).

The results were statistically elaborated. The distribution of the traits was checked by the Shapiro-Wilk test. The differences between the groups were determined by the U Mann-Whitney test (IBM SPSS Statistics 23). The table contains the means of the traits together with the standard deviation.

RESULTS AND DISCUSSION

At slaughter, the fatteners of group A were by about 15 kg lighter than the animals of group B (Table 1). Certain slaughter traits of the fatteners from groups A and B were comparable, e.g. height of the loin “eye” ($P > 0.05$), some of them different significantly, including the backfat thickness ($P \leq 0.01$). The meatiness of the carcasses, colour of meat and its components: L^* , a^* , b^* were similar in the groups ($P > 0.05$). Ellis et al. (1996) and Latorre et al. (2004) explain the darker colour of the meat from heavier fatteners, as obtained in their own studies, by the fact that it may be connected with the myoglobin con-

tent in the muscles which is increased together with the age of the animals. On the other hand, Čandek-Potokar et al. (1998), Weatherup et al. (1998) and Siczowska et al. (2009) – on the grounds of their own studies – stated the lack of relationship between the body weight of the fatteners at their slaughtering and the colour of the obtained meat what confirms by the results of own studies.

The water-holding capacity and free drip were similar in the groups (Table 2). The free drip within the limits of 2–5% in an evidence of normal meat (Borzuta and Pospiech 1999). When comparing the meat samples of fatteners in respect of chemical composition, we may state that any differences between the groups were not found; the total fat content was the only exception. Both the participation of intramuscular fat (IMF) in the meat and its fatty acid profile decide on the sensory parameters of pork meat (Enser 2004). Fat is favourable for improvement of brittleness due to the change in tissue structure; its presence causes that the meat become more delicate (Pospiech et al. 2003). As it is reported by Ellis (2006), IMF for

TABLE 1. Slaughter traits

Trait	Statistical trait	Group		P
		A ($BW \leq 100$) $n = 40$	B ($BW > 100$) $n = 39$	
Body weight (kg)	\bar{x}	92.2 A	107.0 A	0.001
	SD	4.79	4.62	
Height of loin “eye” (mm)	\bar{x}	63.0	62.0	0.569
	SD	7.83	8.32	
Backfat thickness (mm)	\bar{x}	13.1 A	15.4 A	0.001
	SD	2.86	3.11	
Meatiness (%)	\bar{x}	55.2	54.8	0.459
	SD	2.04	2.35	

A, A – the means marked with the same big letters differ statistically at $P \leq 0.01$; BW – body weight.

TABLE 2. Physical traits of meat

Trait	Statistical trait	Group		P
		A ($BW \leq 100$) n = 40	B ($BW > 100$) n = 39	
Colour				
L*	\bar{x}	48.8	48.9	0.857
	SD	3.97	3.67	
a*	\bar{x}	7.9	7.9	0.857
	SD	1.18	1.51	
b*	\bar{x}	3.8	3.5	0.575
	SD	1.98	1.97	
Water holding capacity – WHC (cm ² /g)	\bar{x}	21.4	22.2	0.629
	SD	6.31	7.71	
Free drip (%)	\bar{x}	2.9	2.4	0.133
	SD	1.68	1.18	

BW – body weight.

a good quality meat is found within the limits of 1.8–2.6%. In the own studies, during the evaluation of meat samples in respect of IMF participation, it was found that only the meat from the pigs of group A satisfied the criterion of good quality. In the case of lighter fatteners (group A), the backfat layer was thinner and IMF content was higher compared to heavier animals. The mentioned relationship indicates the possibility of decreasing the level of subcutaneous fat content without simultaneous lowering of IMF. In the opinion of Orzechowska

et al. (2012) it is important and positive information for breeders.

Any differences in the participation of fatty acid groups in the meat obtained from the animals of both groups (Table 3) were not recorded. The participation of the particular fatty acid groups was typical of the species but unfavorable in respect of health of the consumers (Wood et al. 2003). The ratio of polyunsaturated (PUFA) acids and saturated (SFA) acids in human diet, as being desired from the health viewpoint, is equal to at least 0.4 and ratio of PUFA n-6 to PUFA n-3

TABLE 3. Chemical traits and fatty acid profile of *Musculus longissimus lumborum*

Trait	Statistical trait	Group		P
		A ($BW \leq 100$) n = 40	B ($BW > 100$) n = 39	
1	2	3	4	5
Chemical composition (%)				
Dry matter	\bar{x}	26.7	26.8	0.715
	SD	0.80	0.90	
Total protein	\bar{x}	22.9	22.7	0.169
	SD	0.69	0.71	
Crude fat	\bar{x}	1.9 a	1.6 a	0.043
	SD	0.55	0.52	
Crude ash	\bar{x}	1.1	1.1	0.711
	SD	0.09	0.11	

TABLE 3, cont.

1	2	3	4	5
Participation of fatty acid groups (%)				
SFA	\bar{x}	37.68	37.23	0.290
	<i>SD</i>	1.691	0.816	
MUFA	\bar{x}	50.79	52.25	0.067
	<i>SD</i>	2.821	2.306	
PUFA n-6	\bar{x}	6.59	6.35	0.388
	<i>SD</i>	1.148	0.507	
PUFA n-3	\bar{x}	0.49	0.46	0.320
	<i>SD</i>	0.102	0.038	
Ratio				
n-6/n-3	\bar{x}	13.61	13.70	0.808
	<i>SD</i>	1.279	0.865	
MUFA/PUFA	\bar{x}	7.69	7.92	0.512
	<i>SD</i>	1.357	0.830	
MUFA/SFA	\bar{x}	1.40	1.43	0.394
	<i>SD</i>	0.105	0.078	
PUFA/SFA	\bar{x}	0.187	0.182	0.461
	<i>SD</i>	0.031	0.016	

a, a – the means marked with the same small letters differ statistically significantly at $P \leq 0.05$; *BW* – body weight.

below 4. In the analyzed meat samples, the said ratios were equal to 0.2 and 14, respectively.

CONCLUSIONS

The body weight of the pigs before slaughter had an influence on few slaughter and quality traits. The carcasses obtained from lighter animals were characterized by lower fatness, with the preservation of good meatiness. The content of total fat was higher in the samples of meat from lighter fatteners as compared to the heavier animals ($P \leq 0.05$). Any significant effects of the body weight on the remaining chemical traits and on the participation of fatty acid groups in the examined meat samples were not found.

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- Streszczenie:** Wpływ masy przedubojowej tuczników na wartość rzeźną. Przeprowadzono tucz 79 świń mieszańców trójrasowych (pbz × wbp) × × duroc. Zwierzęta utrzymywano i żywiono w sposób ujednolicony. Materiał badawczy podzielono na dwie grupy doświadczalne, przyjmując za kryterium podziału masę ciała przed ubojem (grupa A ≤100 kg, grupa B >100 kg, różnica 15 kg; $p \leq 0,001$). Po uboju określono aparaturowo wysokość „oka” połównicy, grubość słoniny grzbietowej i mięsność tuszy w systemie EUROP. Wykonano także badania jakości mięśnia LL poprzez oznaczenie barwy ($L^*a^*b^*$), zdolności utrzymania wody własnej (WHC) oraz wycieku swobodnego. Określono skład chemiczny prób mięśnia LL, tj.: zawartości suchej masy, białka ogólnego, tłuszczu śródmięśniowego, popiołu surowego, jak również udział grup kwasów tłuszczowych: SFA, MUFA, PUFA n-6, PUFA n-3. Obliczono też stosunek kwasów: n-6 do n-3, MUFA do PUFA, MUFA do SFA, PUFA do SFA. Masa przedubojowa wpłynęła na liczne cechy rzeźne i jakości mięsa. Tusze pozyskane od świń lżejszych charakteryzowało mniejsze otłuszczenie przy zachowaniu dobrej mięsności. Zawartość tłuszczu śródmięśniowego była większa w próbach mięsa tuczników z grupy A w porównaniu z grupą doświadczalną B ($p \leq 0,05$). Nie stwierdzono istotnego wpływu masy ciała na pozostałe cechy chemiczne oraz udział grup kwasów tłuszczowych w badanych próbach mięsa mięśnia LL.
- Słowa kluczowe:* tuczniaki, przedubojowa masa, ilość i jakość mięsa

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