COMPARISON OF SLAUGHTER VALUE AND MEAT QUALITY OF FOUR-BREED CROSSES WITH POLISH LARGE WHITE PUREBRED FATTENERS

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Introduction

For a number of years now, an increasing proportion of typically meat breeds, such as Pietrain, Duroc and Hampshire or their crosses as well as synthetic lines, have been used in Poland in intensive production of fatteners. Introduction of these breeds in intensive production of fattening pigs resulted in a steady increase of fattener meatiness in mass population. Whereas at the beginning of 1990s average carcass meat content was approximately 43%, in 2001 it reached the level of 50.30% (Borzuta 1998, Lisiak 2001). This level was achieved primarily due to the crossing of Polish Large White x Polish Landrace (PLW x PL) sows with Pietrain or Hampshire boars. This type of two- or three-breed crossings in intensive production of swine caused a considerable increase of carcass meatiness but, at the same time, led to increased proportion of meat with quality defects. The frequency of occurrence of such defects depends, to a great extent, on pig breeds (Kim et al., 1996; Koćwin-Podsiadła et al., 1998). Therefore, for several years attempts have been undertaken in Poland with the aim to reduce production of fatteners with meat characterised by quality defects. One of the possibilities to achieve this goal is to produce four-breed hybrids, excluding pigs of Pietrain breed and with a small proportion of Hampshire blood upgrade.

Objective of research project

The purpose of the performed investigations was to determine: slaughter value and proportion of individual carcass elements, carcass meat quality and technological usefulness of intensively produced four-breed fatteners (Yorkshire x Danish Landrace x Hampshire x Duroc) and to compare the obtained data with raw material derived from purebred PLW fattening pigs.

Material and methods

The performed experiments comprised 61 fatteners derived from a medium-intensive pig farm (several hundred fatteners a year). The maternal element in the experimental group (n=31) was two-breed Yorkshire x Danish Landrace sows mated with Hampshire x Duroc breed boars. The control group consisted of purebred PLW fatteners.

Animals were fed complete diets and were maintained in identical environmental and nutritional conditions.

Fattening was terminated when animals reached live weight of about 100-110 kg (half of them gilts the other half – hogs). They were then taken to a slaughterhouse and slaughtered according to regulations in force in meat industry.

The following measurements were carried out on warm, hanging left half-carcasses: estimation of carcass meat content by ham method employing a PLE device (Borzuta 1998), thickness of backfat (by nonius) over shoulder, the last rib and on ham (low back I, II, III). In addition, carcass length from the first rib to the head of pubic symphysis was measured.

Chilled left half-carcasses were divided into basic cuts according to Polish standard PN-86-A/82002. The weight of basic cuts was established on an electronic scale and their percentage proportion was calculated in relation to the weight of chilled half-carcass.

Quality investigations were carried out on *musculus longissimus dorsi* (m. LD). The value of pH 45 minutes (pH_1) and 24 hours (pH_2) after slaughter was determined using a Portable Radiometer PHM 80 equipped in a combined electrode. Electrical conductivity (EC) was measured 24 hours after slaughter using a PQM-L/KOMBI apparatus. Free drip was calculated from the difference of juice secreted from meat stored in plastic bags at 4°C for 48 hours. Water holding capacity was determined by Grau and Hamm method with Pohja and Niinivaar's modifications.

Raw smoked loin was prepared according to a traditional technology, i.e. without functional additives and muscle massaging (Technological Instruction 1986). Sensory evaluations of both cooked meat and smoked loin were performed using a 5 score scale and sample tenderness was estimated by WB method.

Results and discussion

The obtained results confirm a positive impact of four-breed crossing on slaughter value of fattener carcasses, as reported also by other researchers who investigated four-breed hybrids of another genotype (Rak et al., 1993; Buczyński et al., 1996; Różycki 1999, Grześkowiak 1999). In comparison with the control group, 4.52% more meat was found in the experimental group (Table 1). This was further confirmed by a simultaneous diversification in fattiness of animals, which was much lower in the experimental group. Mean backfat thickness from 4 measurements was by 5.02 mm smaller in carcasses of purebred fatteners.

In the experimental group, the total share of high quality carcass retail parts, i.e. ham, shoulder, loin and best end of neck, amounted to 57.21% and was by 6.36% higher in comparison with the control group. Moreover, differences were also found in the proportion of fatty parts, i.e. backfat, yowl and ventral part of belly, which, in carcasses of the experimental group, amounted to 13.29%, while in the control group – 24.09% (Table 1).

Meat quality analyses of the examined genetic groups failed to show PSE, DFD and acid meats determined according to Kaufman (1997) criteria. These observations are corroborated by relatively low values of electrical conductivity recorded for muscles of both groups. It ranged from 2.7 – 6.6 mS, i.e. typical for normal muscles (Strzelecki et al., 1995).

However, in comparison with the control group, a significantly higher drip from muscle tissues of experimental fatteners was observed. Simultaneously, meat water holding capacity in this group was also slightly less favourable and its value was found to be 2.7% higher in relation to the control group (Table 1). On the other hand, weight losses during cooking of meat from both groups were similar and were not found to be statistically significant.

Eikelenborn et al. (1996) maintain that, with the increase of carcass meatiness, the content of intramuscular fat in muscle tissue has a tendency to drop. This was confirmed in our experiments. Approximately 0.9% less intramuscular fat was recorded in the meat of hybrid animals from the experimental group, which showed better musculature (Table 2). According to Wood et al. (1994), the optimal level of intramuscular fat should range from 2 – 3%, as it guaranteed desirable meat palatability.

The performed subjective assessment revealed desirable light-red colour on meat cross-sections from both groups. This observation was further confirmed by results of instrumental measurements (Table 2).

Results of sensory assessment of cooked meat of both examined groups did not reveal significant differences. Results of meat tenderness estimation by the sensory method were also similar, although results of WB measurements turned out more favourable for the

meat from the experimental group. No significant differences were found between groups with regard to technological efficiency of smoked loin (approximately 90%).

However, there are reports that crosses with meatiness over 55%, with 50% upgrade of Hampshire blood, were characterised by approximately 3% lower technological efficiency in comparison with other genotypes (Koćwin-Podsiadła et al., 1998a).

Results of sensory evaluation of smoked loin prepared from muscles of both groups did not differ significantly. They showed a uniform, desirable colour on the cross section and, in this way, confirmed good quality of the examined meat.

Recapitulation

Summing up the obtained research results, it can be concluded that hybrids derived from crossing Yorkshire x Danish Landrace sows with Hampshire x Duroc breed boars were characterised by high meatiness and thinner backfat of the carcass, in comparison with PLW fatteners. No meat with quality defects was found in either of the examined groups. In the course of processing, muscles of both control and experimental fatteners were characterised by favourable technological efficiency and good sensory evaluation. Positive assessment of the slaughter value and meat quality indicates that it is advisable to use four-breed crosses of the examined breeds in intensive production of fatteners.

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Table 1. Results of carcass slaughter value

Traits	Control group	Experimental group
	x	x
Meat content in carcass, %	50,66[A]	55,18
Back fat thickness, mm		
- over shoulder	38,57[A]	33,61
- over the last rib	24,03[A]	19,79
- sacral region I	29,57[A]	25,18
- sacral region II	21,70[A]	15,05
Mean value (4) back fat thickness, mm	28,47[A]	23,46
Total-loin, neck, shoulder, ham with shank, %	50,85[A]	57,21
Total-backfat, yowl, groin, meat of II class	24,09[A]	13,29

A,B – significant $P < 0,01$

Table 2. Meat quality characteeeristic of fatteners in investigated genetic groups

Traits	Control group	Experimental group
	x	x
Water holding capacity, %	33,71[A]	36,42[B]
Drip loss, %	3,54[A]	5,06[B]
Cooking loss, %	26,12	27,67
Fat content, %	3,36[A]	2,46[B]
Colour lightness, %	46,85	46,43
Shear force, meat cooked, kg	7,46	6,31
Smoked loin:		
-Colour lightness, %	44,3	45,62
- Shear force, kg	6,12	5,35