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Frequency of meat quality classes in fatteners from the mass population

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The aim of the study was to evaluate the frequencies of meat quality classes in pigs from the mass population. The study was carried out in the spring/summer season on 220 fatteners. The rearing and pre-slaughter handling conditions were the same for all animals. Slaughter and carcass handling were carried out according to the procedures used at the meat plant. The research material was similar in terms of hot carcass weight (85.27 ±3.06 kg) and lean meat content (58.02 ±2.76%). The results have shown that significant issues for the pork meat industry are acid meat (AM, with low suitability for processing) and exudative meat. The percentage of AM meat was as high as 25%, while 68% was exudative meat within the category of meat assessed as RFN (red, firm, normal). For accurate and detailed conclusions, studies must be conducted in fatteners of known origin (genotype).

KEY WORDS: fatteners / meat quality / quality classes / drip loss

Production of raw pork and pork products whose quality satisfies consumer demand is a very important aspect of the marketing strategies of meat plants. Currently, slaughter of pigs with higher body weight but high meat content is preferred, and the raw meat should have high quality parameters [1, 12, 19, 23]. Pork quality, in a broad sense, is highly variable [8, 18, 22]. Unfavourable changes in the quality of the muscle tissue of fattening pigs are manifested as three types of defective meat, i.e. PSE (pale, soft, exudative), AM (acid meat) and DFD (dark, firm, dry), as well as in the form of meat that has satisfactory quality parameters (RFN) but is exudative, for reasons as yet unknown [7, 8, 9, 10, 17, 21].

The aim of the study was to estimate the frequency of meat quality classes in fattening pigs from the mass population.

Material and methods

The research was carried out in spring and summer on 220 fattening pigs from the mass population (with an equal number of each sex). The housing, feeding (complete feed rations adjusted to age) and pre-slaughter handling conditions were the same for all animals. The pigs were slaughtered according to the technology used at the meat plant. The hot carcass weight (HCW) was determined to the nearest 0.1 kg on a track scale at 35 min after slaughter. The meat content in the carcass was estimated using an ULTRA-FOM 300 ultrasound apparatus from the Danish company SFK Technology. The research material was similar in terms of warm carcass weight (85.27 ± 3.06 kg) and the percentage of meat in the carcass (58.02 ± 2.76%). After slaughter, meat quality was evaluated in the longissimus lumborum muscle (LL), based on the following parameters: muscle acidity (pH), IMP/ATP nucleotide ratio (R_1), and drip loss (WN). The pH was measured in the LL muscle tissue at 45 min (pH_{45}), 24 h (pH_{24}) and 48 h (pH_{48}) post mortem, using a Dramiński MASTER pH meter with a spear tip electrode. The energy conversion index R_1 was determined according to Honikel and Fischer [5]. Drip loss (WN_{48}) was determined according to Prange et al. [14] at 48 h post mortem.

Based on the threshold values presented in Table 1 for the basic meat quality criteria, i.e. $pH_{45,}$ pH_{24}, pH_{48} and R_1, four post-mortem pork quality classes were diagnosed: RFN (meat with correct quality parameters), PSE, AM and DFD. In addition, independently of the basic quality classes, two meat quality groups were distinguished based on the drip loss at 48 h post mortem, where a threshold value of more than 4.0% indicated exudative meat [2]: group 1 – exudative meat ($WN_{48} \leq 4.0$) and group 2 – non-exudative meat ($WN_{48} > 4.0$).

Table 1
Threshold values for selected meat quality criteria [6, 8, 24]

Trait	Meat quality classes			
	RFN	PSE	AM	DFD
pH_{45}	≥6.0	<6.0	≥6.0	≥6.0
pH_{24}	5.6-5.8	5.5-5.7	–	≥6.0
pH_{48}	–	–	≤5.4	–
R_1	<1.05	≥1.05	<1.05	≥1.05

The characteristics of the research material are presented as arithmetic mean ($\bar{x}$), standard deviation (SD) and coefficient of variation (V), which were calculated using the Statistica 12.5 PL statistics package (StatSoft, Tulsa, OK., USA). The frequency of basic quality classes and of meat quality groups distinguished by drip loss was calculated as a percentage. In addition, the share of exudative and non-exudative meat within the category of meat considered normal (RFN) was calculated as a percentage.

Results and discussion

The meat from the analysed pigs was of good quality in terms of muscle acidity at 45 min and 24 h post mortem and the energy conversion index (R_1) (Table 2). The average values for these traits were within the range adopted for meat with normal quality parameters (Table 1). The meat quality parameters were characterized by low variability expressed as the coefficient of variation (V), i.e. 3.22% for pH_{45}, 2.31% for pH_{24} and 5.43% for R_1 (Table 2). Similar meat quality parameters (pH_1, pH_{24} and R_1) to those described above have been reported by Sieczkowska et al. [20] for fatteners of two breed groups, i.e. (Landrace x Yorkshire) x Hampshire and (Landrace x Yorkshire) x Duroc, and by Krzęcio -Nieczyporuk et al. [11] for material from four groups of pigs, i.e. (Landrace x Yorkshire) x Hampshire, (Landrace x Yorkshire) x Duroc, (Landrace x Yorkshire) x (Duroc x Pietrain), and Line 990 x Pietrain.

Table 2
Characterization of research material

Trait	$\bar{x}$	SD	V (%)
pH_{45} LL	6.53	0.21	3.22
pH_{24} LL	5.62	0.13	2.31
pH_{48} LL	5.46	0.11	2.01
R_1 LL	0.92	0.05	5.43
WN_{48} LL	5.70	2.63	46.14

The research results are reflected in the low incidence of meat defects of the PSE type (4.19%), which is characterized by $R_1 \geq 1.05$, $pH_{45} < 6.0$, and pH_{24} in the range 5.5–5.7, and of DFD meat (1.29%), characterized by $R_1 \geq 1.05$, $pH_{45} \geq 6.0$, and $pH_{24} \geq 6.0$ (Table 1, Figure 1). Meat with normal quality parameters (R_1, pH_{45} and pH_{24}) constituted 69.03% (Figure 1). The low percentage of PSE meat may be linked to the genotype of the *RYR1* stress susceptibility gene. Most likely there were stress-resistant individuals, i.e. with the $RYR1^C RYR1^C$ genotype, among the pigs. Quality deviation in the form of PSE meat is most often manifested in animals with the T allele of the *RYR1* gene. The very low percentage of carcasses with DFD meat, on the other hand, is indicative of very good pre-slaughter handling conditions. The DFD defect is determined solely by environmental conditions [6, 7]. Tarczyński et al. [22], in an experiment conducted on fatteners of three breed groups, i.e. (Landrace x Yorkshire) x Duroc, (Landrace x Yorkshire) x Hampshire, and (Landrace x Yorkshire) x (Duroc x Pietrain), also noted a low percentage of carcasses with PSE and DFD meat, amounting to less than 2%.

Particularly noteworthy is the low pH_{48} value of the LL muscle (5.46), with a low coefficient of variation of 2% (Table 2). The pH_{48} of the LL muscle was very close to the

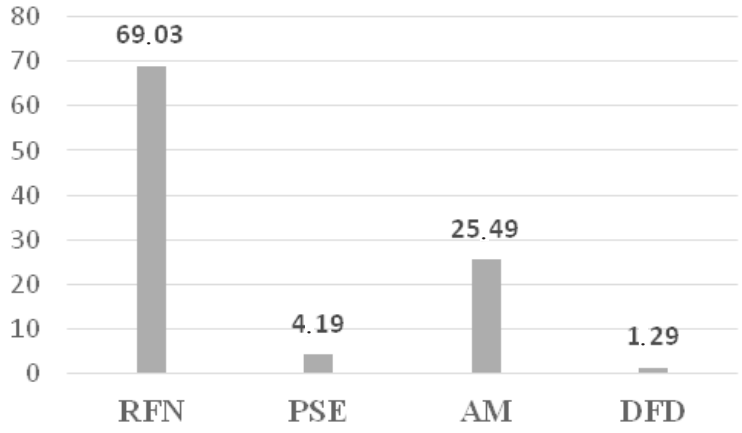

Fig. 1. Frequency of meat classes (%)

threshold value for acid meat (Table 1). A similar pH_{48} value for the LL muscle has been reported by Zybert et al. [25] and by Tarczyński et al. [22] in a group of pigs that were part Hampshire.

The low pH_{48} of the LL muscle in our own research, as well as the research by the authors cited above, is reflected in the high (25.49%) incidence of acid meat (Figure 1), which is characterized by low (final) pH_{48} below 5.4 (Table 1). Acid meat is referred to as 'Hampshire type' meat because it usually occurs in the muscle tissue of pigs burdened with the RN^- allele (Napole yield), i.e. in the Hampshire breed and crosses with this breed. The dominant RN^- allele is responsible for the formation of acid meat, which causes substantial losses during heat processing [3, 7, 13, 15, 17, 20, 24]. Hence there were probably individuals in the analysed pig population whose genetic makeup included the Hampshire breed.

The loss of juice from LL muscle tissue during storage requires detailed analysis. Drip loss is a very important problem from the point of view of the consumer, because excessive drip loss reduces the possibility of selling fresh meat. Moreover, meat plants suffer significant financial losses due to excessive loss of natural juice from muscle tissue during storage and retail sale. According to Fischer [4], in Germany a 1% increase in drip loss, taking into account the tenderloin alone, entails annual losses of about 20 million euros.

In the present study, the drip loss from the LL muscle tissue at 48 h after slaughter was 5.70%, with a high coefficient of variation of 46% (Table 2). According to Bertram et al.

[2], such a high drip loss, i.e. WN_{48} from the LL muscle above 4%, is characteristic of exudative meat.

As indicated in the 'Material and methods' section, the drip loss at 48 hours after slaughter was used to distinguish exudative meat (> 4.0%) and non-exudative meat (≤ 4.0%) (Figure 2). Exudative meat was also diagnosed within the category of meat considered normal (RFN). Exudative meat accounted for 60% of the total research material (Figure 2). Within the category of normal meat (RFN), exudative meat accounted for as much as 68%, while only 32% of meat was non-exudative (Figure 3).

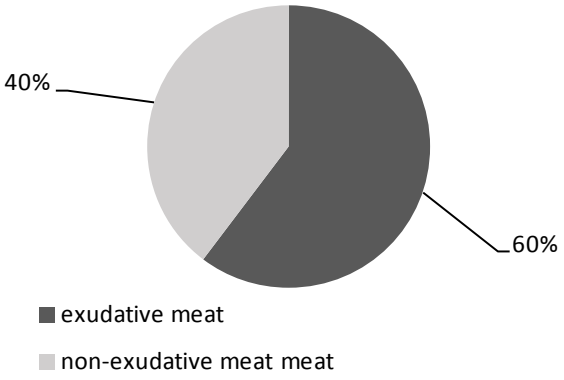

Fig. 2. Frequency of exudative and non-exudative meat in the study population (%)

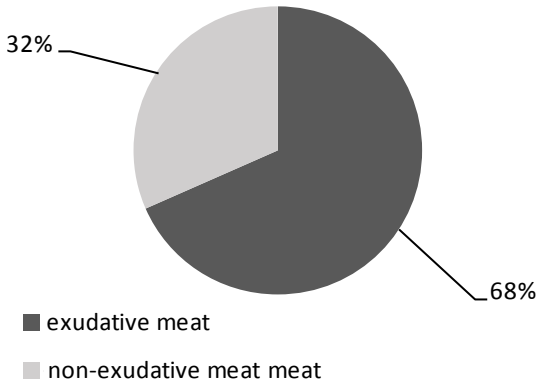

Fig. 3. Frequency of exudative and non-exudative meat among meat classified as RFN (%)

Schäfer et al. [16], in an experiment conducted on fatteners of Danish breeds, i.e. (Landrace x Yorkshire) x Duroc, reported a 55% incidence of exudative meat. Zybert et al. [26], in their analysis of the meat of fatteners from the mass population, found a 67% share of exudative meat. Tarczyński [21] noted a similar drip loss at 48 h post mortem to that obtained in the present study; it was 5.76%, with a coefficient of variation slightly above 50%, while the share of exudative meat was 71%. That research was performed on fatteners of three breed groups: (Landrace x Yorkshire) x Duroc, (Landrace x Yorkshire) x Hampshire, and (Landrace x Yorkshire) x (Duroc x Pietrain).

Summing up, the research results indicate that the occurrence of exudative and acid meat (with low suitability for processing) is a serious problem for the meat industry. In the analysed group of pigs, acid meat accounted for as much as 25%, and the share of exudative meat within the category of normal meat was estimated at 68%. Non-exudative meat accounted for only 32% of RFN (normal) meat. To draw accurate and detailed conclusions, research should be carried out in animals of known genotype (breed group).

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