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Muscle Fibre Characteristics and Physico-Chemical Parameters of *m. semimembranosus* from Puławska, Polish Large White and Pietrain Pigs**

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The aim of the study was to compare muscle fibre parameters and quality of *m. semimembranosus* in pigs. The experiment was conducted with 18 Puławska pigs, 24 Polish Large White (PLW) pigs, and 24 Pietrain pigs slaughtered at 105 kg body weight. The results obtained indicate that the breed of pigs has a significant effect on both muscle fibre composition and vascularization. The muscles of Puławska pigs are the most oxidative, as evidenced by the greatest number of capillaries and the highest percentage of type I and IIA fibres compared to the muscle of PLW and Pietrain pigs. In turn, the most glycolytic muscles (highest percentage of type IIB fibres, poorest vascularization as well as the greatest diameters of muscle fibres of all types under analysis) were noted in Pietrain pigs. Analysis of the physico-chemical parameters of the meat showed the lowest pH_{45}, a* and IMF, as well as the highest L*, drip loss and shear force values in Pietrain pigs compared to Puławska and PLW pigs. Significantly higher IMF, and a* values, as well as lower drip loss, shear force and L* values were observed in Puławska pigs.

Key words: Breed, muscle fibre, meat quality, pig.

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The selective breeding of pigs, which has been carried out for many years to improve fattening and slaughter traits, has considerably increased carcass meatiness and decreased fatness (BORZUTA *et al.* 2005; BLICHARSKI *et al.* 2004; PARK *et al.* 2007; RENAUDEAU & MOUROT 2007; DAI *et al.* 2009). On the other hand, there is a growing negative relationship between the quantity and quality of pig meat (KOĆWIN-PODSIADŁA *et al.* 1998; BORZUTA 2000). Such heavy emphasis on livestock production without a comprehensive evaluation of pork had adverse side effects including metabolic and physiological disturbances, thus reducing the technological and eating quality of pork (KOĆWIN-PODSIADŁA *et al.* 1993).

Poorer meat quality also means poorer water holding capacity and increased drip loss, excessively light colour and differences in saturation, as well as poorer taste and texture (BORZUTA & POSPIECH 1999). One example of fast-growing pigs is the Pietrain breed, which is characterized by very good feed conversion, rapid daily gains, low fatness and high carcass meat percentage. However, meat obtained from the carcass is of low quality (WOOD *et al.* 1999; GRZEŚKOWIAK *et al.* 2009). Thus, increasing attention is paid to the need of improving the quality of pork based on greater use of native breeds in pig breeding. Among Polish native breeds, special consideration should be given to Puławska pigs, which currently represent a highly valuable genetic reserve. This breed did not lose traits inherited from their ancestors, such as resistance to disease and stress, while their meat has a special taste, quality and nutritive characteristics (FLOROWSKI *et al.* 2006; SZYNDLER-NĘDZA *et al.* 2012). Ham is one of the most valuable pig carcass cuts (JÓŻWIAKOWSKA-REKIEL 1985; WAJDA & BĄK 1996). Its high technological and commercial value is due to the content of muscle tissue, which averages 70% (RÓŻYCKI 2003), as well as the possibility of using the ham muscles (including *m. semimembranosus*) for processing. Many authors

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stress that the quality of ham is influenced by many factors, the most important of which is breed (BLICHARSKI *et al.* 1993; ČANDEK-POTOKAR *et al.* 1999). Therefore, the objective of the study was to compare muscle fibre parameters and physicochemical properties of *m. semimembranosus* in pigs of the highly selected Pietrain breed, in meat-type breeds such as Polish Large White, and in the native Polish Puławska breed.

Material and Methods

The experiment was conducted with 18 Puławska pigs, 24 Polish Large White (PLW) pigs, and 24 Pietrain pigs. A complete feed for fattening pigs (T-221 Grower Standard) was offered *ad libitum* from automatic feeders (POLISH FEEDING STANDARDS 1993). All animals were reared under the same environmental and production regime. Pigs were slaughtered at 105 kg body weight in a commercial slaughterhouse. Feed was withdrawn 12 h before slaughter but water was freely available. The pigs were stunned with CO_2 and processed according to normal slaughterhouse procedures.

For microstructural examination muscle samples were taken 45 min *postmortem* from the right carcass side deep within the *m. semimembranosus* and frozen in liquid nitrogen and stored at -80C until histochemical analysis. Serial transverse sections of 10 µm were cut at -20°C in a cryostat (Slee MEV, Germany). Muscle fibre type (I, IIA and IIB) was distinguished using a modified combined method of NADH-tetrazolium reductase activity (DUBOVITZ & BROOKE 1973) and immunohistochemical determination of the slow myosin heavy chain on the same section with monoclonal antibodies against the skeletal slow myosin heavy chain was performed for 1 h at RT (NCL-MHCs, (Novocastra™) Leica Biosystems, Germany, dilution 1:80) (WOJTYSIAK & KACZOR 2011). For identification of capillaries (endothelial cells), frozen sections were immunohistochemically stained with mouse monoclonal antibodies against antigen CD31 (MCA 1746, Serotec) at 1:50 dilution for 60 min at RT. All immunohistochemical reactions were visualized by NovoLink™ Polymer Detection System (Leica Biosystem, Germany), according to the manufacturer's instruction. The percentage of different muscle fibre types was estimated from the number of fibres in 10 muscle bundles in each preparation, whereas muscle fibre diameters were determined based on 100 randomly selected fibres of each type in every preparation analysed. Analysis of capillaries was performed according to the method reported by ŻOŁĄDŹ *et al.* (2005). The number of capillaries (CD) was estimated based on 20 randomly chosen areas (1 mm^2) in each preparation under analysis. In addition, the number of capillaries per muscle fibre (CF) was determined by analysing 100 randomly chosen muscle fibres in each preparation. The preparations were analysed under a Nikon E600 light microscope (Japan), and the measurements were made using MultiScan v.14.02 image analysis system (Poland).

Muscle pH was measured using a Matthäus (Germany) pH meter with a glass electrode standardized for pH 4.0 and 7.0 according to Polish Standard PN-77/a-82058 with automatic correction for muscle temperature at 45 min (pH_{45}) and 24 h (pH_{24}) *postmortem*. The meat colour was assessed 24 h *postmortem* by the L* (lightness), a* (redness) and b* (yellowness) system (CIE, 1976) using a Minolta colourimeter (Chroma Meter CR-310, Minolta Camera C, Osaka, Japan). Drip loss was measured in duplicate samples. After thorough weighing (e=0.001 g), the samples (50 g) were placed in sealed containers. After 24 h the samples were removed, towel-dried, and weighed again. Intramuscular fat content was determined according to PN-ISO 1444/2000 using the Soxhlet method.

Meat samples for Warner-Bratzler shear force (WB) were taken after 24 h of cooling at 4°C. Next, the chops were roasted at 180°C to reach an internal temperature of 78°C and then cooled to room temperature and weighed for thermal loss determination. Then, five 14 mm diameter cores were taken from each chop parallel to the muscle fibre orientation. Shear force was measured using a Texture Analyser TA-XT2 (Stable-Micro Systems, UK) with a Warner-Bratzler unit and a triangular blade.

Differences among the breeds of pigs were analysed using analysis of variance (General Linear Models procedure), and tested for differences by the Tukey test. A probability of $P<0.05$ was considered statistically significant. The data were expressed as least squares means (LSM) ± standard error (SE).

Results and Discussion

The composition and diameter of muscle fibres as well as the number of blood vessels are important factors affecting many biochemical processes in the muscle, which, in turn, determine the ultimate quality of meat.

Earlier studies have indicated that muscle fibre composition is genetically determined (RUUSUNEN & PUOLANNE 1997; GIL *et al.* 2008; RYU *et al.* 2008; WOJTYSIAK & POŁTOWICZ 2014). WEILER *et al.* (1995) provide evidence that intensive selection for increased muscle mass may alter muscle fibre composition by increasing the number of glycolytic fibres (type IIB) and muscle fibre diameter in relation to the native breeds. We found similar relationships in our study when analysing *m. semimembranosus* in three breeds of pigs: the local Puławska breed, the typical meat breed PLW, and the highly selected Pietrain breed (Table 1, Fig. 1A-C). Accordingly, *m. semimembranosus* of the local Puławska breed was characterized by significantly the highest percentage of type I fibres, which are most beneficial in terms of meat quality (RYU & KIM 2005; NAM *et al.* 2009; JOO *et al.* 2013), compared to the PLW and Pietrain breeds, among which the Pietrain pigs exhibited a significantly lower percentage of type I fibres. The higher percentage of type I fibres proves that the muscles of Puławska pigs are more oxidative than those of the other pig breeds under study. In turn, analysis of the percentage of type IIB muscle fibres showed opposite relationships. Here the Puławska pigs were characterized by significantly the lowest percentage of type IIB fibres, and the Pietrain pigs by the highest. The present results are typical of local breeds and meat-type breeds (RUUSUNEN & PUOLANNE 1997; SERRA *et al.* 1998; BOGUCKA & KAPELAŃSKI 2005; RYU *et al.* 2008; WOJTYSIAK 2014). The effect of breed on muscle microstructure has also been confirmed by BOCIAN *et al.* (2012), who reported that *m. longissimus lumborum* in Złotnicka Spotted pigs has a significantly higher proportion of type I fibres and a lower proportion of type IIB fibres compared to the commercial crossbreeds. According to KŁOSOWSKA and FIELDIER (2003), the proportion of individual muscle fibre types has a genetic background and is characteristic of different breeds and crossbreds. The same authors suggest that the higher percentage of glycolytic fibres (IIB) is associated with predisposition to PSE meat. These conjectures are supported by RYU and KIM (2005), who found significant correlations between an increased percentage of type IIB fibres and deteriorating meat quality. Also KŁOSOWSKA (1973), who analysed the structure and quality of *m. longissimus lumborum* in Złotnicka Spotted and Pietrain pigs and their crossbreeds, showed that the lower proportion of glycolytic fibres (IIB) in muscle structure implies more favourable meat quality traits.

As regards muscle fibre size, our analysis showed that breed has a significant effect on this microstructure parameter (Table 1). Accordingly, significantly greater diameters of type I, IIA and IIB fibres were characteristic of the muscles of Pietrain pigs compared to Puławska and PLW pigs. The effect of breed on muscle fibre size was also reported by SERRA *et al.* (1998), BOGUCKA and KAPELAŃSKI (2005) and RYU *et al.* (2008). Similar to what was found in the current study, ORZECHOWSKA *et al.* (2008) found greater diameters of type I, IIA and IIB muscle fibres in the *m. longissimus lumborum* of Pietrain compared to PL and PLW pigs. Differences in the size of muscle fibres in different pig breeds were also noted by GIL *et al.* (2008), who reported greatest fibres in Pietrain and smallest fibres in Meishan pigs.

Muscle function is also importantly affected by vascularization, with the number of capillaries being decided largely by the histochemical profile of the muscles, which is determined by muscle fibre composition. The microstructural analysis of the *m. semimembranosus* performed in the present study showed a significant effect of pig breed both on the number of capillaries per unit area (CD) and on a single muscle fibre (CF) (Table 1, Fig. 2A-C). Accordingly, the highest number of capillaries both per unit area and per fibre was observed in Puławska pigs, and *the lowest in P*ietrain pigs, with both values statistically significant. These results show a clear relationship between the number of capillaries and muscle fibre composition. A greater number of capillaries is characteristic of the muscles with a higher percentage of type I fibres, i.e. oxidative muscles, which was ascertained in the present study for Puławska pigs. This is corroborated by ŻOŁĄDŹ *et al.* (2005), who showed that muscle fibres with greater oxidative capacity (type I) are surrounded by a greater number of capillaries compared to the fibres with smaller oxidative capacity (IIA and IIB). This association is also confirmed by BAUER *et al.* (2006) who analysed the muscles of newborn piglets and demonstrated a positive correlation between capillary density and the number of type I fibres. Few data are available in the literature regarding the effect of pig breed on the content of capillaries in muscle structure, both per unit area and per muscle fibre. Nevertheless, based on the results obtained in the present study, it can be conjectured that the breed factor plays an important role in muscle vascularization. These conjectures are supported by RUUSUNEN and PUOLANNE (1997), who analysed *m. longissimus dorsi* and *adductor* in Hampshire, Landrace and Yorkshire pigs and showed that the greatest number of capillaries per mm^2 was characteristic of the muscles from Hampshire pigs. In turn, when comparing five different muscles: *longissimus dorsi*, *semimembranosus*, *gluteus superficialis*, *infra spinam* and *masseter* in the domestic pig and wild boar, RUUSUNEN and PUOLANNE (2004) found that the density of capillaries in wild boar muscles was twice as high as in pig muscles, which is evidence of the greater oxidative capacity of these muscles. It should also be mentioned that compared to domestic pig muscles, wild boar muscles had a significantly higher percentage of type I muscle fibres and a lower percentage of type IIB fibres. Therefore it can be assumed that such a large number of capillaries in muscles rich in type I fibres,

Table 1

Least squares means (LSM) and standard errors (SE) for muscle fibre composition, capillaries per mm^2 (CD) and capillaries per fibre ratio (CF) of *m. semimembranosus* depending on the breed of pigs

Parameter	Puławska	PLW	Pietrain
Fibre type percentage (%)			
I	15.2 ± 0.48^a	12.1 ± 0.53^b	9.2 ± 0.45^c
IIA	14.5 ± 0.56^a	12.5 ± 0.44^b	10.7 ± 0.39^c
IIB	70.3 ± 0.74^a	75.4 ± 0.96^b	80.1 ± 0.68^c
Fibre type diameter (μm)			
I	49.5 ± 0.87^a	50.2 ± 0.68^a	57.9 ± 0.72^b
IIA	48.2 ± 0.65^a	49.6 ± 0.82^a	58.4 ± 0.48^b
IIB	71.8 ± 0.89^a	72.5 ± 0.76^a	82.7 ± 0.97^b
Capillaries parameters			
CD	217.2 ± 12.6^a	186.7 ± 9.5^b	137.5 ± 10.9^c
CF	1.56 ± 0.07^a	1.23 ± 0.04^b	0.98 ± 0.06^c

Values in rows with different superscript are significantly different: a, b, c ($P<0.05$).

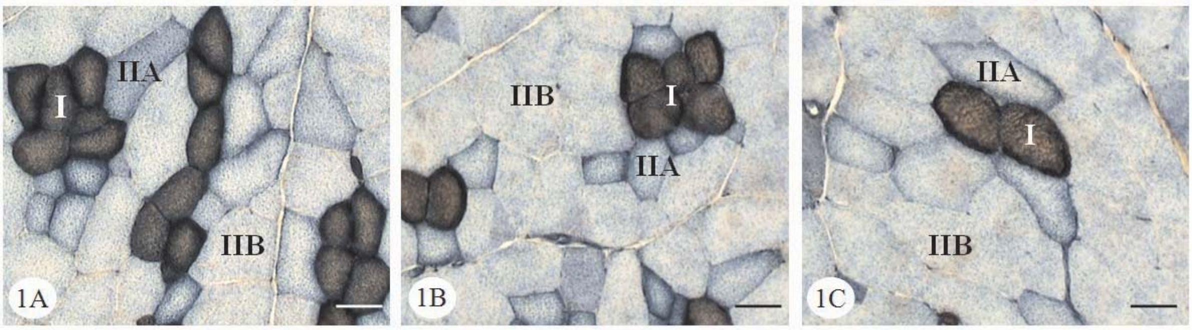

Fig. 1. Exemplary cross-section of *m. semimembranosus* of Puławska (A), Polish Large White (B) and Pietrain (C) pigs: NADH-TR and immunohistochemical MyHC-slow staining: I – red fibres; IIA – intermediate fibres; IIB – white fibres. Bar =50 μm.

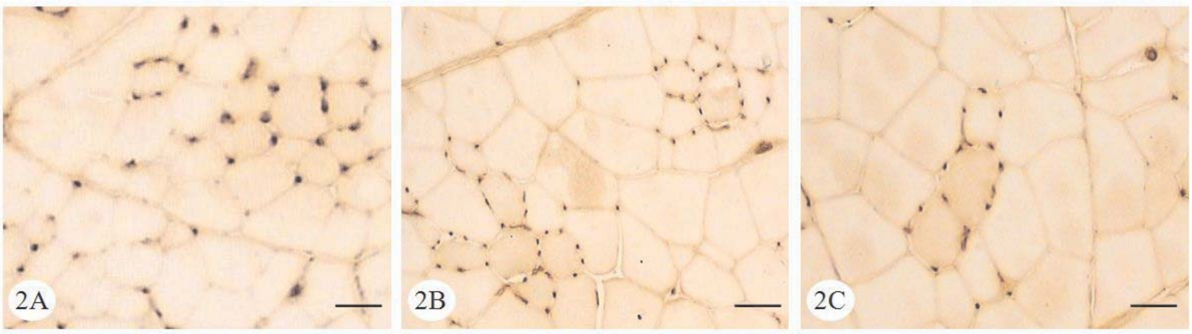

Fig. 2. Exemplary cross-section of *m. semimembranosus* of Puławska (A), Polish Large White (B) and Pietrain (C) pigs: Immunostaining of capillaries with monoclonal antibodies against transmembrane glycoprotein CD31. Bar =50 μm.

which in the present study was the case for the muscles of Puławska pigs, is probably associated with the metabolism of these fibres. Fibres of this type are slow and therefore suited to long duration activities, which require continuous production of energy and thus a constant source of oxygen and nutrients. On the other hand, the "white" muscles rich in type IIB fibres, found in Pietrain pigs, derive most of their energy from the metabolism of endogenous glycogen, and thus the smaller number of capillaries in the muscles with a high percentage of these fibres reflects their anaerobic metabolism.

Technological quality of meat is described by several parameters such as pH, water holding capacity, as well as colour and intramuscular fat

Table 2

Least squares means (LSM) and standard errors (SE) of meat quality parameters of *m. semimembranosus* depending on the breed of pigs

Parameter	Puławska	PLW	Pietrain
pH_{45}	6.59 ± 0.04^{a}	6.56 ± 0.04^{a}	6.08 ± 0.03^{b}
pH_{24}	5.58 ± 0.03	5.62 ± 0.02	5.60 ± 0.02
Colour			
L*	41.24 ± 0.56^{a}	45.38 ± 0.42^{b}	49.69 ± 0.53^{c}
a*	17.23 ± 0.15^{a}	15.52 ± 0.09^{b}	15.37 ± 0.16^{b}
b*	4.18 ± 0.23	4.39 ± 0.18	4.22 ± 0.27
Drip loss (%)	1.38 ± 0.19^{a}	2.17 ± 0.21^{b}	3.81 ± 0.28^{c}
Shear force (kg/cm^2)	5.46 ± 0.17^{a}	6.78 ± 0.24^{b}	7.56 ± 0.19^{c}
IMF (%)	2.98 ± 0.26^{a}	2.15 ± 0.19^{b}	1.36 ± 0.15^{c}

IMF – intramuscular fat content; Values in rows with different superscript are significantly different: a, b, c ($P<0.05$).

(IMF) content. pH measurement is a parameter that allows the raw meat to be provisionally classified as meat free of defects and lower quality meat. Proper pH ensures appropriate water holding capacity, favourable colour, taste and tenderness (JAWORSKA *et al.* 2006). When analysing the pH of *m. semimembranosus* in Puławska, PLW and Pietrain pigs 45 minutes after slaughter, we found statistically significant differences in this parameter among the pig breeds (Table 2). Accordingly, Pietrain pigs were characterized by significantly lower pH_{45} values in relation to Puławska and PLW pigs; these differences were not significant. Similar relationships were reported by BOGUCKA and KAPELAŃSKI (2005), who analysed *m. longissimus lumborum* from PL, Pietrain, Złotnicka Spotted and crossbreed pigs and found the lowest pH_{45} values in the meat of Pietrain pigs. The low pH_{45} in Pietrain pigs may be due to the fact that these animals are susceptible to stress, which considerably accelerates the postmortem metabolism of the muscle and thus the rate of pH decline (FERNANDEZ *et al.* 2002). In turn, BABICZ *et al.* (2013), who analysed *m. longissimus lumborum* and *m. adductor femoris* did not find any significant differences in pH_{45} value between Puławska and PL animals. Meanwhile, KASPRZYK *et al.* (2013), who investigated *m. longissimus dorsi* in Puławska and PL pigs, found pH_{45} to be higher in the Puławska breed. As regards pH measured 24 h postmortem, no significant effect of breed on the value of this parameter was found in this study (Table 2). Likewise, BABICZ *et al.* (2013) reported that breed of pigs has no significant effect on pH_{24}. Different results were obtained by SERRA *et al.* (1998) who analysed *m. longissimus lumborum* and *m. semimembranosus* in Iberian and Landrace pigs. These authors observed higher pH_{24} in Iberian compared to Landrace pigs. Also WOJTYSIAK and POŁTOWICZ (2014), who analysed *m. longissimus lumborum* in Puławska and PLW pigs, noted significantly higher pH_{45} and pH_{24} values in the meat of Puławska pigs. In turn, RYU *et al.* (2008), who studied the histochemical traits of muscles, observed the pH_{45} and pH_{24} of muscles to be much higher in Berkshire than in Landrace and Yorkshire pigs. Moreover, they found that the Berkshire pigs, which showed the highest pH values, had much higher percentages of type I fibres concurrently with a low percentage of type IIB fibres in muscle structure compared to the other breeds. The association between muscle fibre composition and meat pH values is confirmed by RUUSUNEN and PUOLANNE (1997), who demonstrated that the decline in meat pH is significantly faster in "white" muscles which have a high percentage of glycolytic fibres (IIB) than in "red " muscles that are rich in oxidative fibres (I). Therefore, the highest percentage of type IIB fibres and the lowest percentage of type I fibres found in the present work in the muscles of Pietrain pigs compared to the other pig breeds may partly be explained by the lower pH_{45} values found in these animals.

One of the most important characteristics by which consumers judge meat quality is colour. Colour depends on the amount and degree of heme pigment oxidation (FELDHUSEN *et al.* 1995). In the present study, meat colour was defined using the CIE L*, a*, b* scale, where the parameters determine colour lightness, redness and yellowness, respectively (Table 2). The present study found that *m. semimembranosus* of the Pietrain pigs had significantly the highest L* value compared to PLW and Puławska pigs, among which this parameter was significantly lower in the Puławska breed. As regards the a* parameter, a significantly higher value of this variable was noted in Puławska compared to the other breeds, the differences between which were not significant. Moreover, no significant effect of breed on the b* parameter was observed. Earlier research also points to a significant effect of breed on the meat colour parameters. KASPRZYK *et al.* (2013) found that Puławska pigs have a much darker colour of meat compared to PL pigs, as evidenced by a significantly lower L* value and higher a* value for the meat of Puławska pigs. Also FLOROWSKI *et al.* (2006), who analysed *m. longissimus thoracis* of Duroc, Pietrain, PL, PLW and line 990 pigs, concluded that among the studied breeds of pigs, the meat of Pietrain pigs was characterized by the highest meat lightness. According to KOĆWIN-PODSIADŁA *et al.* (1998), the occurrence of light meat colour is associated with a rapid pH decline postmortem and the low pH of mature meat obtained from stress-susceptible pigs. It is also worth emphasizing that the more light the meat is, the more PSE it is and the lower water holding capacity it has. This is determined by muscle structure, which prevents penetration of light into deeper layers of meat, as a result of which the reflection of light is high and thus colour lightness (L*) is high (KARPIESIUK *et al.* 2013). The colour of meat is also influenced by muscle fibre composition. RYU and KIM (2005), who analysed the relationships between muscle fibre characteristics and physico-chemical parameters of pork, showed positive correlations between the percentage of type I fibres and the a* colour parameter, between the percentage of type IIB fibres and the L* colour parameter, and between the diameter of type IIB fibres and the L* colour parameter; this may explain the lighter meat of Pietrain pigs and the darker meat of Puławska pigs found in the present study.

An important parameter in evaluating the technological quality of meat is drip loss. Concerning this trait, *m. semimembranosus* of Puławska pigs was characterized by significantly the lowest drip loss, whereas the muscle of Pietrain pigs showed the highest values of this parameter (Table 2). Drip loss values were intermediate in PLW pigs. The effect of breed on drip loss value was observed by many authors. BOCIAN *et al.* (2012) found that the meat from Złotnicka Spotted pigs had lower drip loss compared to the meat of commercial crossbreeds. Similarly, JANKOWIAK *et al.* (2009) noted lower drip loss in the meat of purebred pigs compared to the crossbreeds. Moreover, PREVOLNIK *et al.* (2009) reported a significant correlation between drip loss and colour lightness L^* ($r = 0.56$). It can therefore be conjectured that the lighter colour of meat from Pietrain pigs observed in the present study is also associated with higher drip loss. In turn, the darker colour of meat from PLW and Puławska pigs is related to lower juice loss. Also muscle fibre composition may be underlying this phenomenon. This is supported by RYU and KIM (2005), who analysed *m. longissimus dorsi,* and observed a positive relationship between drip loss and the percentage of type IIB muscle fibres.

Breed of pigs also has a significant impact on meat texture parameters. In the present study, the lowest shear force was observed for the meat of Puławska pigs, and the highest for Pietrain pigs (Table 2). The effect of breed on the value of this parameter was also reported by FLOROWSKI *et al.* (2006), who showed significantly lower shear force values in *m. longissimus thoracis* of Złotnicka Spotted compared to Puławska and PL pigs. BREWER *et al.* (2002) hold that shear force value is also greatly affected by IMF content. A positive correlation between high IMF levels and texture parameters was noted by many authors (WOOD *et al.* 1994; FERNANDEZ *et al.* 1999). Therefore it appears that the differences in meat tenderness shown in the present study may be largely due to the differences in the value of this parameter. It is generally accepted that native breeds produce more fat than commercial breeds, which may result from the lower meatiness of carcasses from the local breeds (FLOROWSKI *et al.* 2006). These conjectures are confirmed by the results of the present study, where IMF percentage was significantly the highest in the muscle of Puławska pigs, lower in PLW pigs, and the lowest in Pietrain pigs (Table 2). Such a low IMF content in the *m. semimembranosus* of Pietrain pigs is most probably due to the intensive selection of this breed for lean meat yield. KAPELAŃSKI and RAK (1999) showed that IMF content in Pietrain and Złotnicka Spotted pigs and their crossbreeds has halved as a result of 30-year breeding work. Likewise, WAJDA *et al.* (1995) and WOJTYSIAK (2014) demonstrated that the intensive improvement of meatiness has a negative effect on the fat content of *m. longissimus dorsi*. Also KASPRZYK *et al.* (2013) observed significantly higher IMF content in *m. longissimus dorsi* of Puławska pigs compared to the PL breed. SERRA *et al.* (1998) observed a higher percentage of IMF in *m. longissimus lumborum* and *m. semimembranosus* of Iberian compared to Landrace pigs. In addition, IMF content in Iberian pigs was positively correlated to the proportion of type I muscle fibres. Also KARLSSON *et al.* (1999) found IMF content to be significantly correlated to muscle fibre percentage. According to these authors, type I and IIA fibres contain much more intracellular fat compared to type IIB fibres. These differences may arise from the metabolic nature of the fibres, because type I fibres are characterized by oxidative metabolism, IIA fibres are partly oxidative, and IIB fibres are glycolytic.

In summary, the selection of pigs for increased meatiness contributes significantly to increasing the percentage of glycolytic muscle fibres (type IIB) and to decreasing the number of capillaries in the muscle structure, which translates into poorer quality of the meat, as reflected by decreases in pH_{45} and IMF content, increased drip loss, lighter colour, and lower tenderness of the meat.

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