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INCIDENCE OF HISTOPATHOLOGICAL CHANGES IN *LONGISSIMUS LUMBORUM* MUSCLE OF WILD BOAR/DOMESTIC PIG HYBRIDS

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Keywords: wild boar/domestic pig hybrids, muscles, pathological changes

The experiment was carried out on 29 hybrids (21 barrows and 8 gilts) of Duroc sows with wild boar (*Sus scrofa ferus* L.). All the animals were fed (*ad libitum* with composed fix) from weaning up to the age of approx. 8 months. The samples of *Longissimus lumborum* for histopathological study were collected 45 min after slaughter and were frozen with liquid nitrogen. Microscopic preparations were stained according to the Van Gieson method. The following types of histopathological changes were accounted for: changes in fibre size (fibre atrophy, hypertrophy – giant fibres), changes in fibre shape (triangular, trapezoid and elongated fibres), degenerative changes of fibres (necrosis plus phagocytosis, fibre splitting) and connective tissue hypertrophy.

Most often appearing pathological change in the muscle was fiber atrophy. It was observed in all animals. The other changes appeared with greater frequency in gilts. Percentage of particular pathological changes was low, 95.84% of normal fibers were found.

INTRODUCTION

Game meat is valued not only for its taste but mostly for its high health-promoting value. Because of the limited availability of game, and in an effort to meet the increasing nutritional demands of consumers, wild boar pig hybrids were created by crossing wild boars and domestic pigs in an attempt to modify meat product quality [Walkiewicz *et al*., 2004].

It is important to gain insight into the microstructure of wild boar pig hybrid muscles as it highly determines the organoleptic characteristics and meat quality [Wielbo & Lechowski, 2002]. Microstructural analysis of the *Longissimus lumborum* muscle from wild boar pig hybrids derived from the crossing of the domestic pig (*Sus scrofa domesticus* L.) with the wild boar (*Sus scrofa ferus* L.) performed by Elminowska-Wenda [2006], showed smaller diameters of all muscle fibre types, a lower proportion of white fibres, and a much greater proportion of intermediate fibres in comparison with muscles of pig breeds such as Duroc, Polish Large White, Pietrain and their crosses, despite the fact that wild boar pig hybrids were approx. 2-3 months older.

The aim of the present study was to perform microstructural analysis of muscle tissue in the same wild boar pig hybrids in order to estimate the type and extent of pathological changes in muscle fibres, and to determine muscle connective tissue content.

MATERIAL AND METHODS

The experiment was carried out on 29 hybrids (21 barrows and 8 gilts) of Duroc sows with wild boar (*Sus scrofa ferus* L.). All the animals were fed (*ad libitum* with composed fix) from weaning up to the age of approx. 8 months. The samples of *Longissimus lumborum* for histopathological study were collected 45 min after slaughter and were frozen with liquid nitrogen. Muscle samples were sectioned at 10 μm in a Leica cryostat at -25°C and stained using van Gieson's method [Dubowitz *et al.*, 1973]. The following types of histopathological changes were accounted for: changes in fibre size (fibre atrophy, hypertrophy – giant fibres), changes in fibre shape (triangular, trapezoid and elongated fibres), degenerative changes of fibres (necrosis plus phagocytosis, fibre splitting) and connective tissue hypertrophy. The extent of histopathological changes was expressed in per cent and analysis included 200 muscle fibres except connective tissue hypertrophy, which were evaluated subjectively: 0 – no change, + – minor change, and + + – major change.

Nnumerical data were analysed statistically using Statistica 5.5 PL software.

RESULTS AND DISCUSSION

In addition to physicochemical and sensoric methods of evaluation, the estimation of muscle microstructure and the extent of histopathological changes provide information on the quality of raw meat, which is determined by many genetical and environmental factors. Pathologically changed muscle fibres are primarily: atrophic fibres (Figure 1), giant fibres (Figure 2), fibres with cross-section shape different from polygonal (Figure 3). Examples of retrogressive changes

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are fibre necrosis (Figure 4) and fibre splitting (*e.g.* as a result of fibre strain), (Figure 5). Many authors [Kłosowska *et al*., 1994, 1995; Kłosowska & Kapelański, 1997] have linked them to the susceptibility of animals to unfavourable environmental conditions. Overgrown connective tissue is a lesion that does not directly concern muscle fibres (Figure 6). It can cause blood vessels pression leading to degenerative changes in muscle fibres and has a negative effect on meat tenderness. It also reduces meat biological value because of mostly from endogenous amino acids content in the tissue.

In the present study on the *Longissimus lumborum* muscle of wild boar pig hybrids, over 95% fibres were normal (Table 1). The percentage of normal muscle fibres was higher than in Polish Landrace, Złotnicka Spotted and Pietrain breeds of pigs [Bogucka *et al*., 2006a] and crossbreds [Bogucka *et al*., 2006a; Bogucka & Kapelański, 2004a], despite the fact that wild boar pig hybrids were approx. 2-3 months older. In Stamboek and Torhyb crossbreds, the percentage of normal fibres was approx. 92% in *Longissimus lumborum* muscle [Bogucka & Kapelański, 2004a] and approx. 94% in the *Semimembranosus* muscle [Bogucka *et al*., 2006b]. The lowest proportion of normal fibres was found in Polish Landrace and Pietrain pigs (89.81% and 88.33%, respectively) [Bogucka *et al*., 2006a]. In wild boar pig hybrids, the high percentage of normal fibres in the analysed muscle was probably due to housing conditions and the effect of boar genes. Pigs had access to free range throughout the fattening period which caused additional movement improving blood supply to the muscles. This was also observed by Elminowska-Wenda [2006], who found approx. 42% oxidative fibres (both red and intermediate) in the same animals, a proportion that was much higher than in the studies of other authors involving fattening pigs [Kłosowska *et al*., 1998; 2001; Bogucka & Kapelański, 2004b; 2005]. In the present study the most common was muscle fibre atrophy (2.04%), although this value was lower than in other pig breeds and crossbreds [Bogucka & Kapelański, 2004a; Bogu-

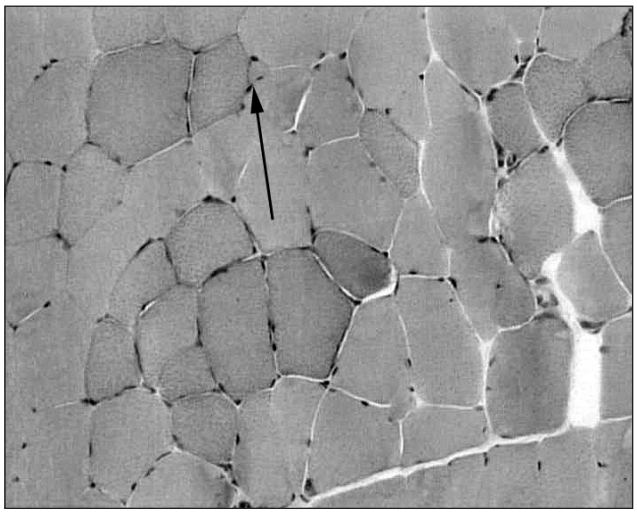

FIGURE 1. Cross section of *musculus longissimus lumborum* of wild boar/domestic pig hybrid no 351 (♂). Fibre atrophy (arrow). 12.5 × 10 magnification.

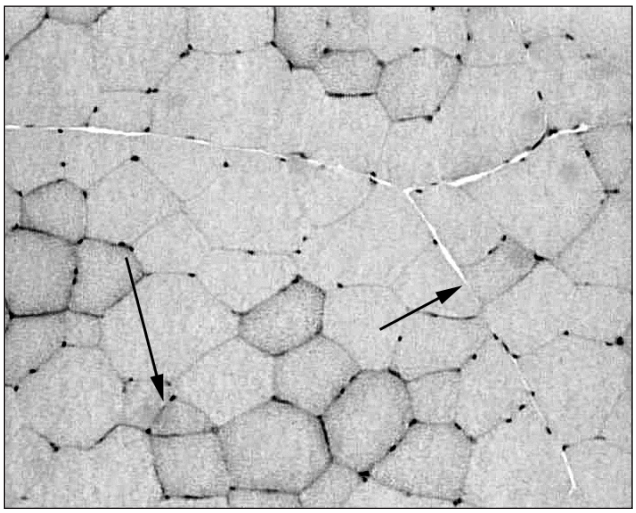

FIGURE 3. Cross section of *musculus longissimus lumborum* of wild boar/domestic pig hybrid no 371 (♂). Changes in fibre shape (arrows). 12.5 × 10 magnification.

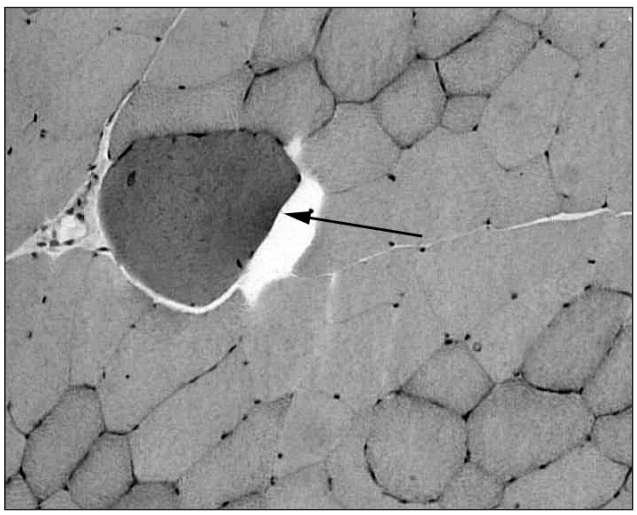

FIGURE 2. Cross section of *musculus longissimus lumborum* of wild boar/domestic pig hybrid no 368 (♀). Giant fibre (arrow). 12.5 × 10 magnification.

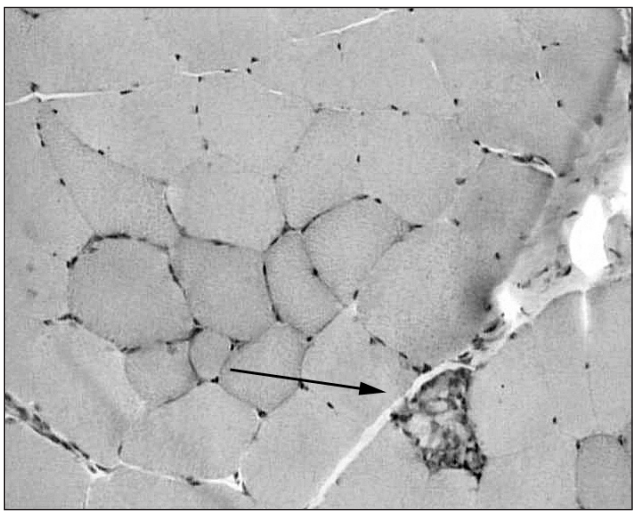

FIGURE 4. Cross section of *musculus longissimus lumborum* of wild boar/domestic pig hybrid no 347 (♂). Fibre necrosis with phagocytosis (arrow). 12.5 × 10 magnification.

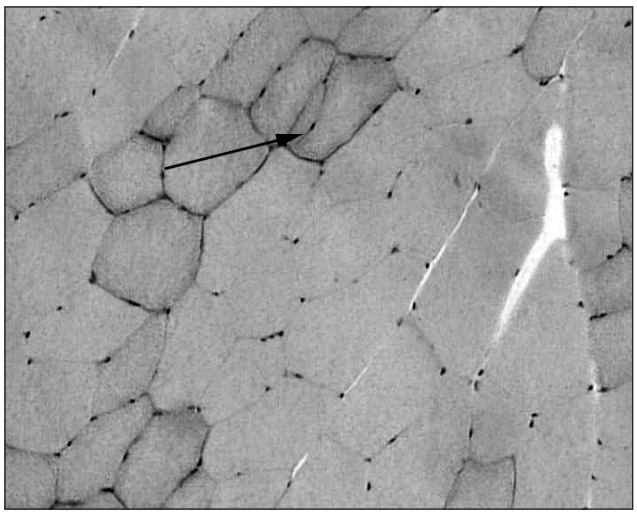

FIGURE 5. Cross section of *musculus longissimus lumborum* of wild boar/domestic pig hybrid no 368 (♀). Fibre splitting (arrow). 12.5 × 10 magnification.

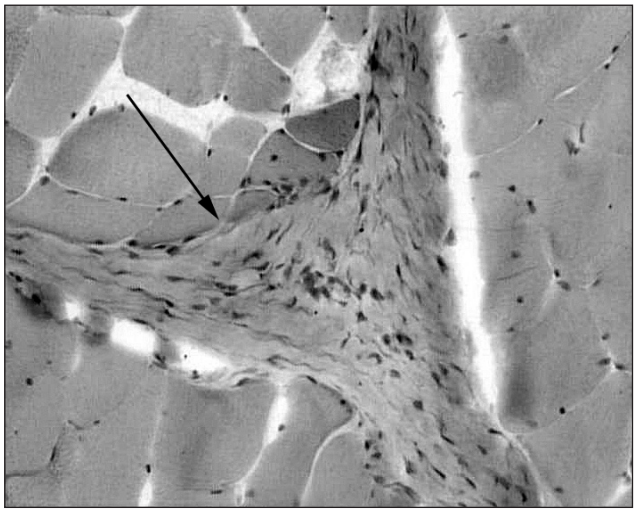

FIGURE 6. Cross section of *musculus longissimus lumborum* of wild boar/domestic pig hybrid no 354 (♂). Connective tissue hypertrophy (arrow). 12.5 × 10 magnification.

cka *et al*., 2006a]. There was 1% of fibres with changed shape and giant fibres. This value is comparable with the values obtained in the studies mentioned earlier. For giant fibres, the results were similar to those obtained by Szmańko *et al*. [2002], who found that normally such fibres account for approx. 1% of total muscle fibres. Splitting (0.11%) and necrosis with phagocytosis (0.02%) were the least frequent changes. Compared to other pig breeds and crossbreds, the latter change was similar only to the value obtained in the *Longissimus lumborum* muscle of Stamboek pigs (0.03%) [Bogucka & Kapelański, 2004a]. In terms of sex, no significant changes were found between barrows and gilts.

The percentage of animals with different changes is shown in Figure 7. The most frequent change in the muscle of wild boar pig hybrids was muscle fibre atrophy, which was observed in all the animals. The other changes were more frequent in gilts.

TABLE 1. Percentage participation (%) of pathological changes in *musculus Longissimus lumborum* of wild boar/domestic pig hybrids.

Traits		Barrows	Gilts	Total
Normal fibres	$\overline{x}$	95.69	96.17	95.84
	SD	1.71	1.10	1.54
Atrophic fibres	$\overline{x}$	2.10	1.93	2.04
	SD	1.26	0.97	1.16
Giant fibres	$\overline{x}$	0.86	1.06	0.93
	SD	1.02	1.21	1.07
Changes in fibre shape	$\overline{x}$	1.19	0.75	1.05
	SD	0.81	0.33	0.72
Fibre necrosis and phagocytosis	$\overline{x}$	0.01	0.03	0.02
	SD	0.03	0.05	0.04
Fibre splitting	$\overline{x}$	0.14	0.06	0.11
	SD	0.18	0.10	0.16

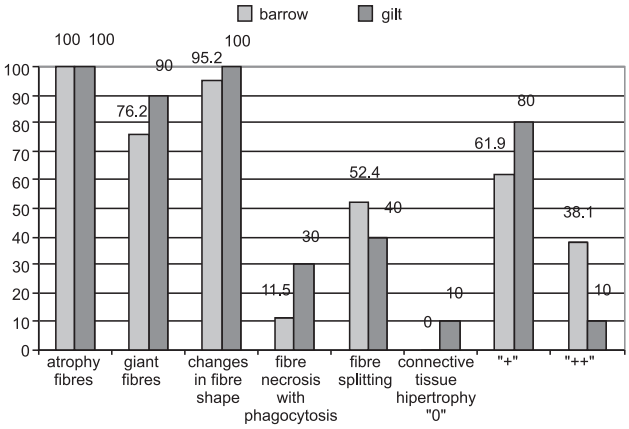

FIGURE 7. Percentage of animals showing pathological changes in *musculus Longissimus lumborum* of wild boar/domestic pig hybrids.

CONCLUSIONS

The most frequent change in the muscle of wild boar pig hybrids was muscle fibre atrophy, which was observed in all the animals. The other changes were more frequent in gilts.

The estimation of the extent of pathological changes in the *Longissimus lumborum* muscle of wild boar pig hybrids, used to complement the analysis of anatomical muscle structure showed a greater percentage of normal fibres (95.84%) compared to other groups of pigs and pig crossbreds studied by other authors. The percentage of particular pathological changes was lower in many cases, which can be attributed to the effect of boar genes and different housing conditions (access to free range and, as a result, better blood supply to the muscles).

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CZĘSTOŚĆ WYSTĘPOWANIA ZMIAN HISTOPATOLOGICZNYCH W MIĘŚNIU *LONGISSIMUS LUMBORUM* ŚWINIODZIKÓW

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Celem pracy było rozszerzenie badań mikrostrukturalnych o badania histopatologiczne mięśnia *Longissimus lumborum* świniodzików.

Badaniami objęto 29 mieszańców (21 kastratów i 8 loszek) pochodzących z krzyżowania loch rasy Duroc z dzikiem europejskim (*Sus scrofa ferus*). Wszystkie zwierzęta tuczono (żywienie *ad libitum* mieszanką standardową) do wieku 8-9 miesięcy. 45 minut po uboju z mięśnia najdłuższego z części lędźwiowej (*m. Longissimus lumborum* – LL) pobrano próbki do badań histopatologicznych i zamrożono je w ciekłym azocie. Następnie sporządzono preparaty mikroskopowe i poddano je barwieniu Van Giesona. Uwzględniono zmiany wielkości włókien mięśniowych (atrofia, hipertrofia – włókna olbrzymie), zmiany kształtu włókien (włókna trójkątne, trapezowate, wydłużone), zmiany degeneracyjne włókien (martwica z fagocytozą, rozszczepienie) oraz przerost tkanki łącznej.

Najczęściej występującą zmianą patologiczną w mięśniu świniodzików była atrofia włókien mięśniowych. Obserwowano ją u wszystkich zwierząt. Pozostałe zmiany z większą częstotliwością występowały u loszek. Procentowy udział poszczególnych zmian patologicznych był niski, w badanym mięśniu stwierdzono 95,84% włókien prawidłowych.