Available online at www.sciencedirect.com
SCIENCE DIRECT®
Meat Science 71 (2005) 244–248
MEAT SCIENCE
www.elsevier.com/locate/meatsci

Effects of carcass weight and muscle on texture, structure and myofibre characteristics of wild boar meat

J. Żochowska *, K. Lachowicz, L. Gajowiecki, M. Sobczak, M. Kotowicz, A. Żych

Department of Meat Science, Agricultural University of Szczecin, Kazimierza Królewicza 4, Szczecin 71-550, Poland

Received 20 September 2004; received in revised form 18 February 2005; accepted 21 March 2005

Abstract

Texture, histology and muscle fibre characteristic of selected muscles: *m. quadriceps femoris* (QF), *m. biceps femoris* (BF), and *m. semimembranosus* (SM) of wild boars of different carcass weight (20 ± 2 and 60 ± 3 kg SD) were compared. Muscle texture (hardness, cohesiveness, springiness, chewiness) was determined with the double penetration test performed with the Instron 1140 apparatus. Structural elements (muscle fibre cross-section area, *perimysium* and *endomysium* thickness) and percentage of myofibres of each type: I (slow oxidative), IIA (fast oxidative-glycolytic) and IIB (fast glycolytic) per muscle fibre bundle, were measured in muscle samples using a computer image analysis program. The young wild boar muscles showed significantly lower values for the textural parameters ($p < 0.05$). The muscle fibre cross-sectional areas of the juvenile wild boar muscles were significantly lower and the *perimysium* and *endomysium* thinner ($p < 0.05$) than those in the old wild boar meat, while the percentage of type IIB fibres was higher. Of all the wild boar muscles tested, the highest hardness and chewiness values were found in BF which, at the same time, showed the highest fibre cross-sectional area and the thickest *perimysium* and *endomysium*. The highest percentage of I and IIA fibre types was typical of BF and SM either in young or in old wild boars with the lowest percentage of type I and the highest percentage of type IIB fibres being found in the QF. The results suggest that a higher hardness of wild boar muscles can be connected with a thicker *perimysium* and *endomysium*, fibres of higher cross-sectional area and probably a higher content of red fibres (type I).

Keywords: Wild boars; Carcass weight; Texture; Structure; Muscle fibre types

1. Introduction

According to numerous authors livestock muscles differ in terms of textural parameters (Dransfield, 1977; Harris & Shorthose, 1988; Shackelford, Reagan, Mann, Lyon, & Miller, 1989), structure (Dransfield, 1977; Liu, Nishimura, & Takahashi, 1996), and muscle fibre types (Kłosowska & Fiedler, 2003; Ruusunen & Puolanne, 2004; Solomon & Dunn, 1988; Wegner et al., 2000).

Relationships between livestock carcass weight as well as between meat texture and histology of their muscles were demonstrated by Dransfield (1977), Kołczak, Palka, and Zarzycki (1992), Liu et al. (1996).

Despite the similarity between pigs and wild boars, wild boar meat should be treated as a different raw material. The histochemical composition of wild boar meat differs to some extent from the histochemical composition of pork (Ruusunen & Puolanne, 2004). The differences are caused by life style and feeding pattern differences experienced by wild boars and pigs (Korzeniowski, Bojarska, & Cierach, 1991; Prost, Pełczyńska, & Libelt, 1985; Rede, Pribisch, & Rehelić, 1986; Ristić, Živković, & Aničić, 1987).

* Corresponding author. Tel.: +48 91 423 1061; fax: +48 91 423 3448.
E-mail address: ztm02@fish.ar.szczecin.pl (J. Żochowska).

0309-1740/$ - see front matter © 2005 Elsevier Ltd. All rights reserved.
doi:10.1016/j.meatsci.2005.03.019

Wild boars of different weights are consumed nowadays in Poland. A comparison of shot wild boars indicates that most of the animals have weights between 20 and 70 kg (Dzierżyńska-Cybulko & Fruziński, 1997). It should be expected, that the mass of the carcass could be an important factor in its texture, histology and as a result it might also influence its technological usability.

Therefore, this study was aimed at comparing selected muscles of wild boars of different carcass weight in terms of their texture, structure and fibre types.

2. Materials and methods

2.1. Source of animals

A total of 10 carcasses from wild boars, of two different ages (five carcasses in each group), shot during winter in an enclosed area in the forest of the Western Pomeranian District were used. The carcass weights of the wild boars were 20 ± 2 and 60 ± 3 kg, while their ages were 0.5 and 3 years, respectively.

2.2. Carcass and sample preparation

Shortly after being shot (30–45 min) $1 \times 1 \times 0.5$ cm samples were taken from the mid-part of muscles *biceps femoris* (BF), *semimembranosus* (SM), and *quadriceps femoris* (QF), frozen in liquid-nitrogen and stored at −80 °C for muscle fibre characteristics analysis.

Carcasses were transferred to cold room of the Agricultural University of Szczecin. Half-carcasses of the experimental animals, kept at 4 °C for 48 h from the moment of shooting were used to obtain 10 hams from each group, of pH 5.7–5.9. Each ham was deskinned, deboned, and cleaned of external fat. The following muscles were dissected out of the hams: BF, SM, and QF of mass about 0.55–1.30, 0.50–1.10, and 0.50–0.90 kg, respectively. After trimming, each muscle, of both groups of wild boars, weighed about 450–550 g.

About 1.2 cm thick slices were cut perpendicularly to the fibres from each muscle. Subsequently, samples for additional structural analyses were cut from the slices. The remaining two parts, were brought together so that their cut surfaces touched and they were placed in elastic thermally shrunk nets, tightly wrapped in thermoresistant plastic sheets, and cooked in water at 85 °C until the geometric centre reached 68 °C. The cooked samples were cooled under tap water to about 12 °C, wrapped in plastic to prevent desiccation and stored at 4 °C for 12 h.

2.3. Objective measurement of meat structure and texture

2.3.1. Myofibre classification and measurements

Myofibre characteristics were made on liquid-nitrogen-frozen samples of muscle. In order to classify the muscle fibres into type I, IIA and IIB groups, cross-sections (10 μm) were cut at −26 °C with a cryostat HM 505 EV. The sections were placed on glass slides, stained using the myosin ATPase method (Guth & Samaha, 1970) with an alkaline preincubation solution (pH 10.4), and classified according to Brooke and Kaiser (1970) into three groups: type I (slow oxidative), type IIA (fast oxidative-glycolitic), and type IIB (fast glycolytic).

Stained sections were examined with the image analysis system using a computer program (Multi Scan Base v.13). The following parameters were computed: percentage of different fibre types (%) (type I, type IIA, and type IIB) per muscle fibre bundle, and more than 10 bundles were examined for each muscle sample. A magnification of 100× was used.

2.3.2. Structure elements measurements

Histological assays were made on samples cut from the mid-part of the BF, SM, and QF muscles of both groups of animals, three cuts being taken from each muscle. The samples were dehydrated in alcohol, fixed in Sannomiya solution, and embedded in paraffin blocks. The blocks were sectioned with a microtome. The sections were placed on glass slides, contrast-stained with hematoxylin and eosin, and sealed with Canada balsam (Burck, 1975).

The Multi Scan Base v.13 computer image analysis software was used to evaluate the fibre cross-sectional area, *perimysium* and *endomysium* thickness. A magnification of 100× was used. The structural elements were measured in an area of fibre bundle, and more than 200 muscle fibre and *perimysium* and *endomysium* thickness/samples were analyzed.

2.3.3. Texture measurements

Texture measurements were made on the cooked meat at about 18 °C. After removal of the plastic sheets, 20 ± 2 mm thick slices were cut out from each sample to determine their texture on an Instron 1140 apparatus interfaced with a computer. The texture was evaluated using the double penetration test. The test involved driving a 0.96 cm diameter shaft twice, parallel to the muscle fibre direction into a sample down to 70% of its height (14 mm), using a crosshead speed of 50 mm min^{-1} and a load cell of 50 N. The force-deformation curve obtained served to calculate meat hardness, cohesiveness, springiness and chewiness (Bourne, 1982). The procedure was repeated 9–14 times on each sample.

2.4. Statistical analyses

Statistical analyses of the data involved the calculation of the mean values and standard deviations (SD) for each muscle and each group of wild boars. The differences in textural and histochemical properties