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Relationships between Muscle Fiber Characteristics and Changes of Pork Loin Quality during 14 d of Cold Storage

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Objectives

Most studies investigating the relationship between muscle fiber characteristics and pork loin quality have focused on early postmortem characteristics. However, the influence of muscle fiber characteristics on aged pork loin quality or changes in pork loin quality during storage have not been fully investigated. Therefore, the present study was conducted to investigate the relationships between muscle fiber characteristics and changes of pork quality during 14 d of cold storage.

Materials and Methods

Pigs (PIC 280 boar × Camborough sow, $n = 22$, HCW = 93.4 ± 7.1 kg) used in this study were randomly selected from a single lot that were slaughtered at a commercial abattoir. Loins (*longissimus dorsi*) were removed from pork carcasses at 24 h postmortem (PM), vacuum-packaged, and transported to the University of Illinois. At 36 h postmortem, a 2.54 cm thick chop was cut from the 8th through 10th thoracic vertebra region to be used for immunohistochemistry. An additional chop was used to evaluate 36 h pH, instrumental color, National Pork Producers Council (NPPC) color, cooking loss and Warner-Bratzler shear force (WBSF). The rest of loin was vacuum-packaged and stored at 4°C until 14 d PM. After 14 d of storage, pork quality characteristics were evaluated again. Differences (Δ) of pork quality between the 2 storage points were calculated as the value at 14 d minus the value at 36 h PM. Four pure fiber types (I, IIA, IIX and IIB) and 3 hybrid fiber types (I-IIA, IIAX and IIXB) were classified using 4 monoclonal antibodies (BA-D5, SC-71, BF-35 and BF-F3, DSHB, IA). Relative fiber number (%) and area (%) and cross-sectional area (CSA) were analyzed from approximately 500 fibers per sample. Data were analyzed using a paired *t* test to compare loin quality at 36 h and 14 d PM. Pearson correlation coefficients were determined for the relationships between muscle fiber characteristics and changes (Δ) of loin quality traits during storage. Both differences and correlation coefficients were considered significant at $P \leq 0.05$.

Results

Muscle fiber type IIB had the highest proportion (55.06% relative number and 66.31% relative area; $P < 0.0001$) and the largest size (5949.0 μm^2; $P < 0.0001$) among the fiber types; whereas, the proportion of type I was the lowest (9.38% relative number and 6.15% relative area; $P < 0.0001$) among the pure types.

NPPC color score decreased (Δ = –0.55; $P < 0.0001$) and WBSF decreased (Δ = –0.90; $P < 0.01$) during cold storage; whereas, CIE L* (Δ = 3.55; $P < 0.0001$), a* (Δ = 0.86; $P < 0.01$) and b* (Δ = 2.35; $P < 0.0001$), and cooking loss (Δ = 2.11; $P < 0.05$) increased during cold storage. Relative number and area of type I fibers were positively correlated ($r = 0.52$, $r = 0.46$, respectively; $P < 0.05$) with Δ cooking loss, and CSA of type I was positively correlated ($r = 0.48$; $P < 0.05$) with Δ CIE a*. The relative number and area of type I-IIA fibers were negatively correlated ($r =$ –0.47; $r =$ –0.46; $P < 0.05$) with Δ CIE a*. Relative number and area of type I-IIA fibers were also negatively correlated ($r =$ - 0.52; $r =$ –0.55; $P < 0.05$) with Δ NPPC color. Relative area and CSA of type IIB fibers were positively correlated ($r = 0.44$; $r = 0.47$; $P < 0.05$) with NPPC color.

Conclusion

Muscle fiber characteristics are related with changes of pork quality during cold storage. In particular, the rate of discoloration is closely related with type IIB fiber size and proportioin of type I-IIA fibers.

