EFFECT OF HIGH POWER ULTRASOUND ON TENDERNESS OF PORK *M. BICEPS FEMORIS*

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Key Words: Pork, high power ultrasound, tenderness, myofibrillar fragmentation

Introduction

Tenderness is one of the most important quality attributes of eating quality. A variety of chemical, physical and mechanical methods have been used for tenderizing meat. Use of high power ultrasound which can cause physical disruption of materials has been shown to reduce Warner-Bratzler shear force in bovine *semitendinosus* and *longissimus lumborum et thoracis* muscles without compromising other quality characteristics such as water holding capacity, cooking loss and colour (Jayasooriya et al., 2007). It is not clear if high power ultrasound affects the toughness of porcine muscles, and if so, which components (i.e. myofibrillar and/or connective tissue) of meat toughness that could be is affected by the ultrasound treatment. The objective of the present study was to investigate the effect of high power ultrasound treatment on tenderness of porcine *biceps femoris*.

Materials and Methods

From 11 pigs *biceps femoris* muscles from the left and right side of the carcass was excised 24 hours post-mortem (p.m). The muscles were vacuum packed and stored at -20ºC until use. Prior to analyses, the muscles were thawed for 24 hours at 2ºC. Each muscle was divided in three pieces of identical size, vacuum packed and thereafter ultrasound treated (25 kHz, 300 W, 1ºC) for 0, 10 or 40 minutes in an ultrasound water bath. Samples were then stored for 24 hours at 2ºC. From each sample 10g of meat were taken for determination of myofibrillar fragmentation and the remaining piece used for Warner-Bratzler shear test. The samples were vacuum packed and MFI samples were stored at -20ºC until use, and samples for Warner-Bratzler shear test were cooked by suspending individual bags in a water bath at 75ºC for 1 hour. Cooking was arrested by placing the slices in ice-cold water for 1 hour. Four rectangular shaped blocks (1 x 1 x 5 cm) were removed from the cooked muscle samples. Each block was sheared three times perpendicular to the muscle fibre direction with a triangular shaped blade on an Instron Universal testing machine. For each muscle sample, the average of 12 shear values represented the WB shear force value. The crosshead speed was 50 mm/min. Maximum loads required to shear through the samples were recorded. Myofibrillar fragmentation was measured according to Lametsch et al. (2007).

Results and Discussion

Warner-Bratzler shear force. Ultrasound treatment of porcine *biceps femoris* for 40 minutes decreased ($P < 0.02$) toughness as compared to control (Figure 1). However, 10 minutes ultrasound treatment did not show a significant decrease in toughness and hence it appears that this length of time is not sufficient to affect tenderness. Myofibrillar fragmentation was determined in order to investigate if myofibrils were mechanically weakened by ultrasound treatment.

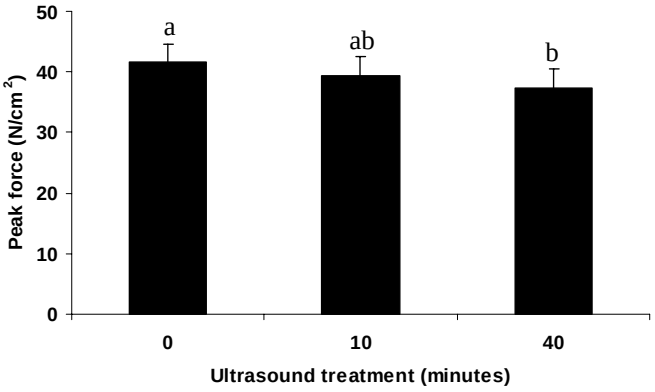

Figure 1. Influence of ultrasound treatment (25 kHz, 300 W, 1ºC) on Warner-Bratzler shear force of pork *M. biceps femoris*. Samples were either exposed to 0, 10 or 40 minutes of ultrasound treatment in an ultrasound waterbath. Columns represent LS-means with standard errors. Columns with the same letter are not significantly different ($P < 0.05$).

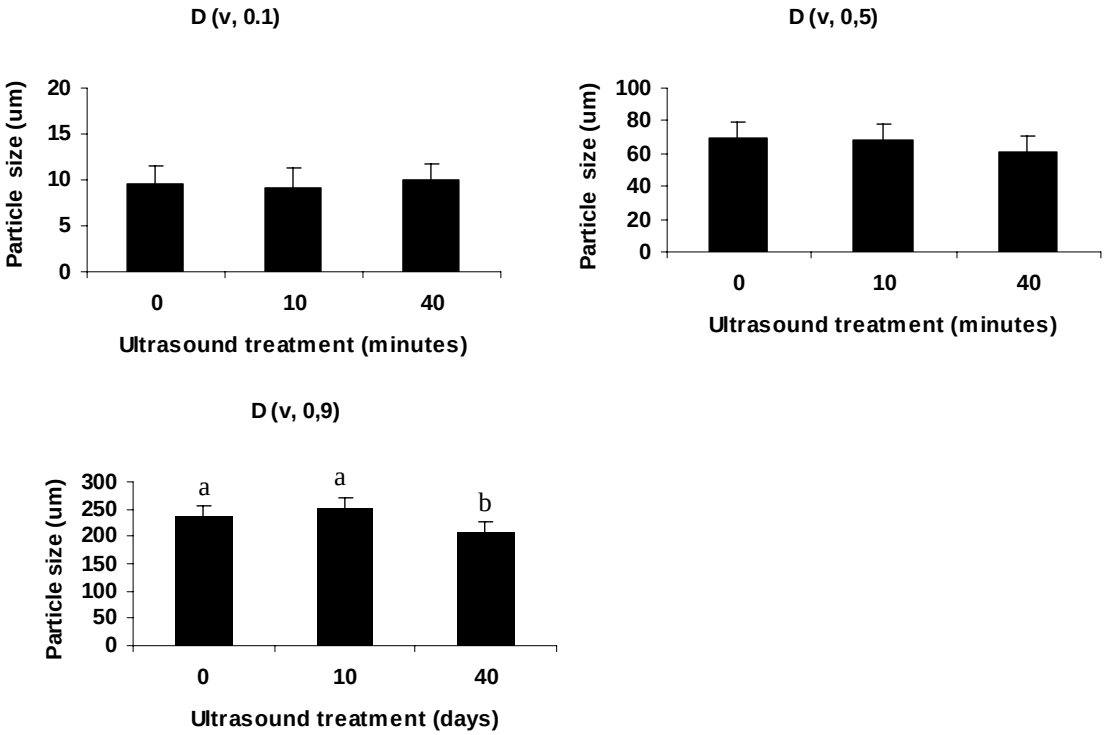

Figure 2. Fragment or particle size distributions, after homogenization of partly purified myofibrils. *D*(*v*,0.1) is the fraction of particles including the 10% smallest particles (10th percentile). *D*(*v*,0.5) is the fraction of 50% smallest particles (50th percentile, or the median). *D*(*v*,0.9) is the fraction including 90% of the smallest particles (90th percentile). Columns represent LS-means and standard errors.

Myofibrillar fragmentation. Ultrasound treatment for 10 and 40 minutes did not result in significant changes in particle size from *D*(*v*,0.1) or *D*(*v*, 0.5) as compared to control samples (Figure 2). Significant fragmentation of particles into smaller sizes was, however, observed from *D*(*v*,0.9), when samples were ultrasound treated for 40 minutes as compared to control samples. Together our results suggest that ultrasound treatment does weaken the myofibrillar component of meat toughness. This effect may be due to an increased proteolytic activity induced by the ultrasound treatment or to a physical disruption of the myofibrillar structure. It remains to be elucidated if ultrasound treatment also affected the connective tissue component of *biceps femoris*.

Conclusions

High power ultrasound treatment of pork *biceps femoris* for 40 minutes improves tenderness. Applying ultrasound for 40 minutes also result in increased fragmentation of the myofibrillar component of meat. However, it remains to be elucidated if high power ultrasound treatment also affects the connective tissue component of meat toughness.

References

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