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Impact of slaughter method on lamb *Musculus longissimus thoracis et lumborum* quality attributes (#181)

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Introduction

A recent study indicated a decrease in tenderness of cooked *longissimus dorsi* muscle of Icelandic lamb during the last two decades (Thorkelsson & Eythórsdottir, 2018). Probable reasons for this trend include a combination of effects from breeding for increased muscle and decreased fat using progeny testing based on ultrasound measurements of live animals (Eiriksson & Sigurdsson, 2017), and changes in slaughter practices with faster chilling of lamb carcasses together with low voltage electrical stimulation. This treatment increases the risk of cold shortening and heat toughening (Warner et al., 2010).

The aim of this study was to investigate whether different slaughter systems, affect quality attributes in Icelandic lamb meat. This is of special interest since artisanal slaughter with slower carcass chilling is said to result in meat with higher tenderness.

Methods

Meat from 20 lamb carcasses were studied. Lambs used were intact ram lambs in twin pairs, one slaughtered at a commercial abattoir (slaughtering 2500 lambs/day) and the other in a local artisanal abattoir (slaughtering 75 lambs/day). Age at slaughter was 150-160 days. All lambs rested at the abattoir for 12 hours overnight without feed, but with *ad libitum* water. All carcasses were hung by the Achilles tendon after dressing.

Commercial abattoir

The transport time from the farm to the commercial abattoir was three hours in a ventilated lorry. The lambs, were stunned electrically (head to back) with 110 V, 50 Hz for 5 s and exsanguinated. After dressing and evisceration the carcasses were electrically stimulated with 10A and 80 volts for 60 seconds before entering the chiller. The carcasses were then chilled at 2-4°C for 30 hours before sampling of *M. longissimus thoracis et lumborum* (LTL).

Artisanal abattoir

The transport time was 30 minutes from the farm to the artisanal abattoir. All lambs were stunned with a captive bolt pistol and exsanguinated. The carcasses were kept at 10-15°C for approximately the first six hours after slaughter and then chilled at 3-4°C overnight.

Sampling, packaging, handling and analyses of M. longissimus thoracis et lumborum

Carcass characteristics such as conformation (five classes) and fat score (six classes) ,according to the EUROP scale, as well as hot and cold carcass weight was registered. LTLwith subcutaneous fat were cut from the carcasses, between the last lumbar vertebrae and the seventh thoracic vertebrae, 24-30 hours after slaughter. Muscles from the left side of all carcasses were aged for 6-7 days after slaughter at 2-4°C and analysed fresh. All muscles were analysed for sensory properties, WBSF (Warner Bratzler shear force), NIR (Near Infrared Spectroscopy), NMR (Nuclear Magnetic Resonance Spectrometer), pH and colour measurements (L* (lightness), a* (redness), and b* (yellowness)). Sensory evaluation was carried out using a trained panel of 6-10 panellists on five different sessions. Meat was cooked sous vide at 68°C for one hour and then fried very lightly in a dry pan. Panellists evaluated each sample on a scale from 1 to 100. Shear force was analysed on cooked meat with sample dimension of 1x1x3 cm (width x height x length) that were cut orthogonal to the fibre direction.

Statistical analyses

Statistical analysis was performed using the Statistical Analysis Software (SAS 9.4, SAS Inst. Inc., Cary, NC, USA). Data were analysed using Proc GLM, with slaughter method as fixed effect. Differences with a p-value <0.05 were considered significant. Principal Component Analysis (PCA) was performed in Unscrambler X (Camo AS, Oslo, Norway) on all data to find similarities and differences between the two treatments. The data was centred and weighed with the inverse of the standard deviation of each variable to correct for the use of different units.

Results

Variation in meat quality measurements was higher within slaughterhouses than between them resulting in very little statistical differences between the two slaughter treatments. The only significant differences were observed in grading for fatness (2.3 in commercial and 2.5 in the artisanal, $p < 0.0001$). Differences in classification of fatness could to some extent be explained by different classifiers at the different slaughterhouses, which could affect the results. Results of the shear force show no significant difference between the slaughter methods but the results confirm that Icelandic lamb meat has become less tender, since the shear force values from this study (42.2 N/cm^2 in commercial and 49.0 N/cm^2 in artisanal) are higher than result presented in previous studies, 1.75 kg/cm^2 (Sanudo et al., 2003). The PCA analysis (Fig. 1) showed a partial overlap of the samples from the two slaughter methods, indicating only minor differences in the meat due to the two treatments. The

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PCA was in good agreement with the analysis of the individual parameters.

Conclusion

Very little differences were obtained in the studied meat quality attributes of fresh lamb meat between the industrial and artisanal abattoirs. The effects of breeding for muscular and leaner carcasses needs to be studied further.

Acknowledgements

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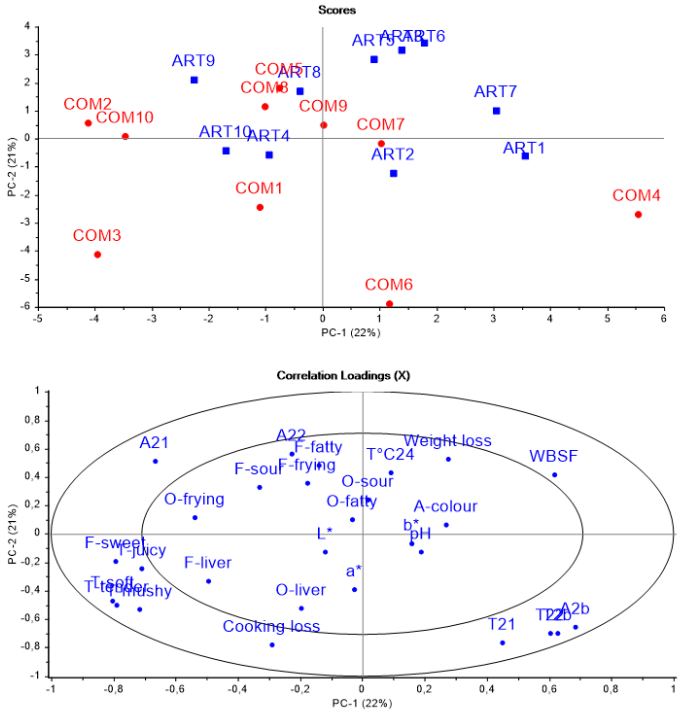

PCA scores and loadings of all studied variables from the artisanal and commercial slaughter methods Figure 1: PCA scores (top) and loadings (bottom) of all studied variables in fresh meat from the artisanal (ART) and commercial (COM) slaughter methods. Numbers describe the twin lamb pairs.

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