DEGRADATION OF MYOSIN LIGHT CHAIN DURING POST-MORTEM AGEING IS ASSOCIATED WITH MEAT TENDERNESS IN NGUNI, BONSMARA, BRAHMAN AND CHAROLAIS.

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Abstract - Inconsistent tenderness has a significantly negative economic impact on the beef industry. Proteomics analyses of longissimus lumborum of four beef breeds Nguni, Bonsmara, Brahman and Charolais were used to evaluate meat tenderness during post-mortem ageing. The results shows that myosin light chain has a positive correlation with Warner-Bratzler shear values in all the breeds in which myosin light chain abundance decreased between day 0 and day 3 post-mortem. These results highlight that the degradation of myosin light chain might be an indication of meat tenderness

Key words – Bovine myosin light chain 1 (MLC1), muscle protein degradation proteomics

I INTRODUCTION

Inconsistent tenderness has a significantly negative economic impact on the beef industry. In a study by Sawdy et al. [1] bovine myosin light chain 1 (MLC1) concentration from ribeye steaks collected in 36 h post-mortem were determined to be positively related with Warner-Bratzler shear values in matched ribeye steaks aged 7 days. There is a serious need in the beef industry for a precise, rapid, and consistent method to predict tenderness of individual beef carcasses before further processing. Although the exact mechanisms leading to tenderness are not well understood, investigators associate both enzymatic protein degradation and the state of the actin/myosin interaction with meat tenderness [2, 3,]. In this paper highlights the association of abundance of myosin light chain with Warner-Bratzler shear values.

II MATERIALS AND METHODS

Snap frozen longissimus lumborum muscle (200 mg) was homogenised in 1 ml TES buffer as formulated by Jia et al. [4] and subjected to 2-D SDS-PAGE. The extracts were centrifuged (30 min, 13000 rpm, 4 °C) to remove TES insoluble proteins. Protein concentrations were measured (RC-DC Protein Assay Kit, Bio-Rad, USA) by means of an ELX Universal micro-plate reader at 750 nm with BSA as a standard. Protein separation in the first dimension was performed on immobilised pH gradient (IPG) strips (Bio-Rad, USA), 24 cm, pH 5-8. Protein extracts (850 µg) were loaded onto each IPG strip by passive rehydration for overnight at room temperature. Isoelectric focusing (IEF) was performed using the Ettan IPGPhor II unit (GE Healthcare BioSciences, Uppsala, Sweden) by means of a stepwise programme: 500 V for 2 h, increase to 1000 V for 2 h, increase to 10000 V for 3 h, 10000 V for 7:36 h. In the second dimension, proteins were separated on 12% SDS-PAGE using the Ettan DALT six large format vertical system (GE Healthcare Bio-Sciences). Gels were stained by coomassie brilliant blue (G250). Gels were fixed and stained overnight. Stained gels were transferred to neutralisation buffer (Tris-base 0.1 M pH 6.5 by o-phosphoric acid) for 1-3 min, and washed with 25% methanol for 1 min and stored in stabilising solution (20% ammonium sulphate). Gels were imaged and processed using Chemi-doc Mp (Bio-Rad Hercules, CA, USA) equipped with Image Lab software. Proteins were identified by Maldi tof-tof spectrometry.

II RESULTS AND DISCUSSION

Myosin light chain showed a decrease in abundance as the Warner-Bratzler shear force decrease in all the breeds. These results are in accordance with Lametsch et al. [5] were by they demonstrated that post-mortem degradation of actin, myosin light and heavy chain were related to meat tenderness.

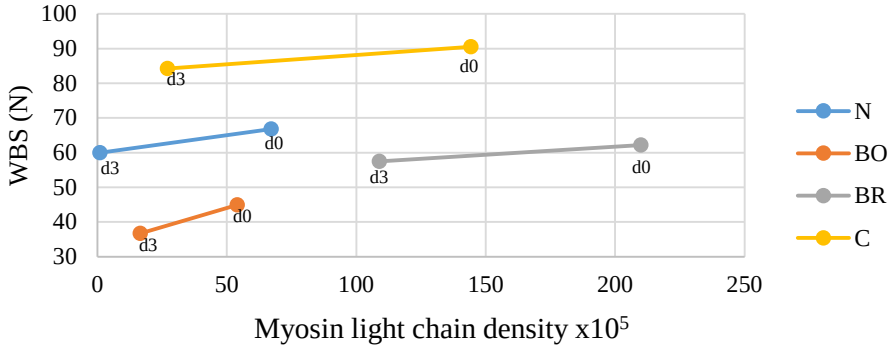

Figure 1. The relationship between Warner-Bratzler shear force (WBS) and relative abundance of myosin light chain in relative to ageing between day 0 and day 3 in Nguni (N), Bonsmara (BO), Brahman (BR) and Charolais (C).

These results emphasise the notation that the degradation of the thick filament components at 36 h post-mortem might be a good predictive measure of tenderness. Myosin light chain degradation may play a role in the decline of the interaction between myosin and actin, causing a weakened actomyosin bond, which in turn contribute to increased tenderness by exposing myosin to proteolytic degradation.

IV CONCLUSION

These results highlight that the degradation of myosin light chain might be an indication of meat tenderness potential. The largest decrease in abundance differences take place early post-mortem and therefore future studies looking at the behaviour of myosin light chain degradation at shorter post-slaughter time intervals such as 15 min, 60 min, 3 h, 6 h and 24 h are warranted.

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