Changes in protein composition related to tenderness in bovine *longissimus thoracis* muscle

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Abstract— **Tenderness is considered the most important quality trait of beef by consumers, and reducing the unacceptable levels of variation in tenderness remains an important goal for the meat industry. The results show no significant changes in the sarcoplasmic protein fraction according to tenderness in these samples by PLSR analyses. However, there was a significant effect of pH 1 h post mortem on tenderness, and 11 protein spots were significantly changed according to variation in pH at this time-point.**

Keywords— **tenderness, beef, proteomics.**

I. INTRODUCTION

Tenderness is considered the most important quality trait of beef by consumers, and reducing the unacceptable levels of variation in tenderness remains an important goal for the meat industry. A large variation in beef tenderness has been reported, and identification of markers for meat tenderness in cattle has gained attention in recent years.

Previous studies of proteome changes in bovine M. *longissimus thoracis* biopsies from living animals and postmortem muscle samples indicate that a wide range of metabolic proteins including glycolytic enzymes and stress proteins changed in abundance.

The main goal of the present study was to identify proteins related to tenderness in beef.

II. MATERIALS AND METHODS

Muscle samples from *longissimus thoracis* were collected 1 hour post mortem from 10 tender and 10 tough muscles from Norwegian Red dual purpose bulls. Tenderness was measured as WBSF in the same muscles 7 days post mortem. Tender group, WBSF 39-41; Tough group, WBSF 80-83. Sarcoplasmic proteins were extracted from all samples, labelled with G-Dyes and separated by 2-DE using IPG 5-8 and 12.5% SDS-PAGE. Gel images were analysed using SameSpots v 4.1. The resulting data were further analysed by partial least squares regression (PLSR) using protein spots as x-variable and WBSF values as y-variable.

III. RESULTS

A representative gel image is shown in Figure 1.

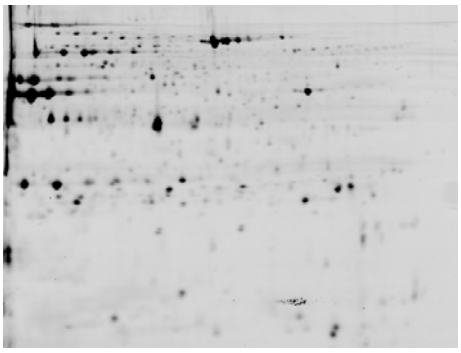

Fig.1. Representative gel image of sarcoplasmic proteins from bovine *longissimus thoracis* collected 1 h post mortem and separated by IPG 5-8 and 12.5% SDS-PAGE.

Gel images were aligned and divided in a tender and tough group based on the WBSF measurements. PLSR analyses of the data did not identify any significant protein spots according to tenderness, see Fig.2, but were able to group the samples as shown in the scores plot. As shown in the loading plot of Principal Components 1 and 2, only 19% of the variation in the protein spots explains 85% of the variation in tenderness in these samples. None of the protein spots were significantly changed according to tenderness. No differences were observed in the results when the WBSF values were used in the regression (data not shown).

Previous studies have suggested a correlation between pH and tenderness. We had measured pH at 1, 6, 10 and 48 h post mortem in the same muscle and used PLSR to investigate whether we could observe a correlation between tenderness and pH at the different time-points in these samples. The loading plot is shown in Fig. 3.

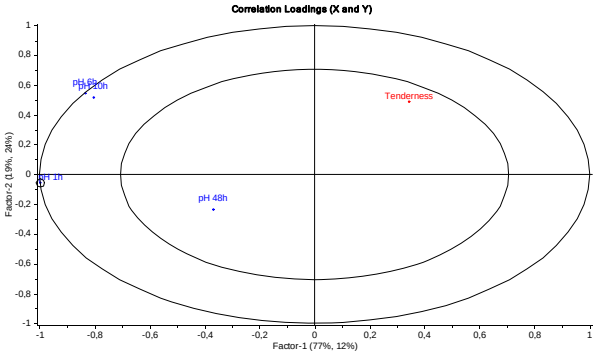

Fig. 3. PLSR showing the relation between Tenderness (Y-matix) and pH 1-48 h post mortem (X-matrix).

Based on the significant association between pH 1 h post mortem and tenderness, we decided to analyse whether we could observe any significant changes in the protein abundance patterns related to pH. The result from the PLSR analysis is shown in Fig. 4. As the loading plot shows, several proteins spots vary significantly according to the pH measured at 1 h post mortem. These proteins will be identified to unravel their potential function and relation with post mortem pH decline and meat tenderness.

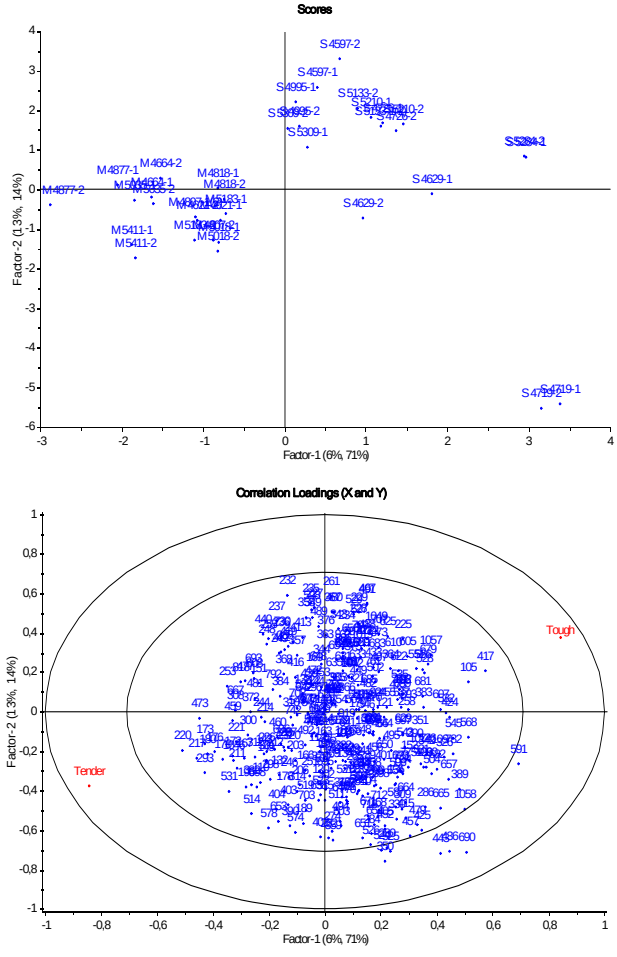

Fig. 2. Scores (top) and loadings (bottom) plots of principal components 1 and 2 from the PLSR analysis. Protein spots are used as the x-matrix and Tender/Tough are used as category variables in the Y-matrix.

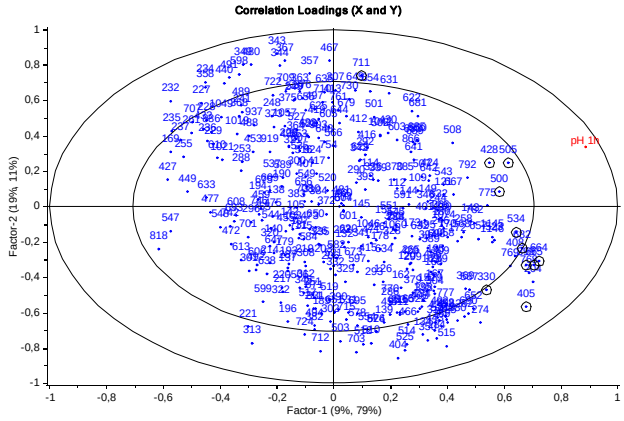

Fig. 4. Loading plot from PLSR analysis of protein spots (X-matrix) and pH 1 h post mortem (Y-matrix). Significantly changed proteins spots are circled.

IV. CONCLUSIONS

The results show no significant changes in the sarcoplasmic protein fraction according to tenderness in these samples by PLSR analyses. However, there was a significant effect of pH 1 h post mortem on tenderness, and 11 protein spots were significantly changed according to variation in pH at this time-point.

ACKNOWLEDGMENT

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