

Influences of pig breed and slaughter age on cathepsin B+L activity in fresh meat and dry-cured hams

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Abstract— Cathepsin are group of muscle proteinases that are suggested to play a major role in the quality of dry-cured hams. Cathepsins B and L are two of the main muscle endopeptidases. They are cysteine proteinases, which are active through the entire dry-curing process. The main aim of this study was to investigate cathepsin B+L activity in fresh meat and in mature dry-cured hams produced from three different pig breeds (Duroc, Norwegian Landrace and Hampshire) at three different slaughter ages (6, 7.5 and 9 months). Significant differences of cathepsin B+L activity was observed in fresh meat between the breeds ($p < 0.05$) and the highest activity was observed in the samples from the Hampshire breed. In matured dry-cured hams produced from Hampshire pigs, the cathepsin B+L activity was significantly lower than in hams produced from Duroc ($p < 0.05$). No significant differences among the age groups neither in fresh meat nor in dry-cured hams were observed. However, a tendency towards a decrease between the 6 months and 9 months old pigs were observed in the fresh meat samples.

Keywords— cathepsin B+L, pig breed, slaughter age.

I. INTRODUCTION

Cathepsins play a major role in muscle proteolysis post mortem and the proteolytic activity is involved in obtaining high quality dry-cured hams [1]. Cathepsin B and L are two of the main muscle proteinases (endopeptidases). Their optimum pH is around 6, which is the pH that hams obtain during processing [2]. This allows the cathepsin B + L to be active during the entire dry-curing process.

Several studies have shown the influences of pH [3, 4], NaCl concentration [3, 4], temperature [4], pig weight [5], sex [6], and sire [6] on the cathepsin activity. One study indicated differences in cathepsin activities among different pig breeds [7]. To our

knowledge, however, the effect of age and breed on cathepsin B+L activity in fresh meat as well as dry-cured hams have not been extensively investigated.

The objective of this study was to investigate the effects of pig breed and slaughter age on the cathepsin B+L activity in fresh meat and dry-cured hams.

II. MATERIALS AND METHODS

Experimental design: A total of 90 samples of *adductor* muscle, collected 45 min after slaughter, of three breeds (Norwegian Landrace, Duroc and Hampshire) slaughtered at three ages (6, 7.5 and 9 months) were used in this study. All animals were from the same farm and slaughtered the same day at the same abattoir. Dry-cured hams were produced from the same pigs at Nortura Tynset, Norway.

Sample extraction: Sample extraction was performed mainly as previously described with minor modifications [8]. Briefly, 300 ± 5 mg of muscle/dry-cured ham samples were homogenized with 1000 ± 15 μ l of extraction buffer (50 mM sodium acetate pH 5.0 containing 1 mM Na_2EDTA and 0.2 % (v/v) Triton X-100 at 4°C) using the Precellys 24 tissue homogenizer. The extracts were stirred at 4°C for 30 min and centrifuged at 13000 rpm for 30 min. Supernatants were stored at -80°C until use.

Cathepsin B+L activity: Assay was performed as described by Toldra and Etherington [8]. Briefly, the activity of cathepsin B+L was determined at 37°C and pH 6.0. Samples were incubated with fluorescent substrate (Z-Phe-Arg-NMec) for 10 min. The reaction was stopped by adding 2 ml of 100 mM monochloroacetic acid in 100 mM acetate buffer, pH 4.3. A standard curve was made using 25 – 200 nM 4-amino-7-methyl coumarin dissolved in a stop buffer. Fluorescence was measured with excitation and

emission wavelengths at 355 and 460 nm, respectively. All samples were analyzed in triplicates.

Statistical analysis: The data were analyzed using Minitab 16 software and p-values less than 0.05 were considered statistically significant.

III. RESULTS

In the present study a total of 178 samples (90 fresh meat and 88 dry-cured ham) were analyzed for cathepsin B+L activity.

A significant effect of breed on cathepsin B+L activity was observed in samples from both fresh meat and dry-cured hams. In fresh meat the highest cathepsin B+L activity was observed in Hampshire and it was higher than both Duroc and Norwegian Landrace ($p < 0.05$) (Fig 1.). However, dry-cured hams from Hampshire had the lowest cathepsin B+L activity and the results was lower than in the samples from the Duroc breed ($p < 0.05$). No difference was observed in cathepsin B+L activity between the Norwegian Landrace and Duroc as well as between Norwegian Landrace and Hampshire (Fig 2.).

No differences among the age groups neither in fresh meat nor dry-cured hams was detected (not shown). However, a tendency towards a modest decrease in cathepsin B+L activity with slaughter age in fresh meat was observed (p-value??).

IV. DISCUSSION

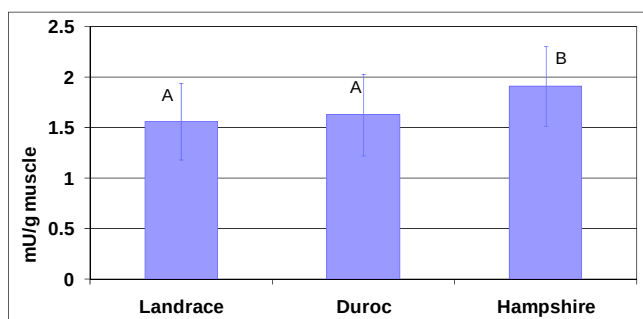


Fig 1. Cathepsin B+L activity in meat samples collected from adductor muscle 45 min post-mortem. Bars with letters A and B differ significantly.

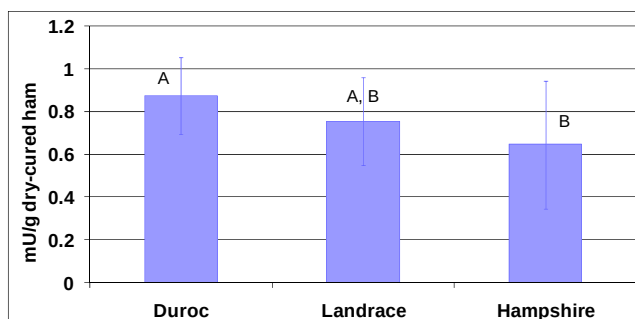


Fig 2. Cathepsin B+L activity in dry-cured hams from *B. femoris*. Bars with letters A and B differ significantly.

In the present study significant differences in cathepsin B+L activity among the breeds were observed. Hampshire pigs had a higher cathepsin B+L activity than Norwegian Landrace and Duroc ($p < 0.05$). The higher cathepsin B+L activity in Hampshire pigs could be due to the higher body weight in this breed compared to the Norwegian Landrace and Duroc. We observed a tendency in reduction of cathepsin B+L activity with slaughter age.

V. CONCLUSIONS

The results show that there are differences in cathepsin B+L activity among the three breeds that has been investigated in this study. Further work is in progress to relate cathepsin B+L activity with sensory attributes in these dry-cured hams.

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