



Proteolytic Effects of Marinades Containing Actinidin

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Objectives

Kiwi fruit contains the cysteine protease actinidin, which belongs to the same class of enzymes as papain and bromelain. Several studies have shown that meat becomes more tender when injected with these enzymes. The objective of this study was to evaluate the proteolytic effects of actinidin in bovine *semitendinosus* muscle at high (6.4) and low (5.5) pH conditions, by monitoring degradation of desmin and myosin light chain.

Materials and Methods

Kiwi fruit powder (OT-1005X), which contains the proteolytic enzyme actinidin, was obtained as a gift from the producer (Ingredient Resources Pty Ltd, Australia). Four different marinades (A-D) were prepared. Na₅P₃O₁₀ was used to obtain the high pH-marinades. Marinade A: 0.5% kiwi powder, 3% phosphate and 3% NaCl. Marinade B: 0.5% kiwi powder and 3% NaCl. Marinade C: 3% phosphate and 3% NaCl. Marinade D: 3% NaCl. From a commercial abattoir *M. Semitendinosus* from 6 young bulls (Norwegian Red) were purchased. Four d post mortem the muscles were cut into 5 slices (approximately 3.5 cm thick), and pH was measured. One slice from each muscle was further cut into small pieces (approximately 2 mm wide). The other slices were injected to 110% weight with the A-D marinades and kept at 4°C in sealed plastic bags for 14 d. Then Warner-Bratzler (WB) shear force was measured on these muscle slices after cooking in water bath at 70°C for 50 min. The finely cut muscle samples, from the fifth slice, were mixed with marinades (A-D) and stored in tubes for either 3 h, 3 d or 14 d. At the given times excess liquid was removed and muscle samples were frozen. Then the meat samples were homogenized

in Tris-EDTA buffer. Degradation of desmin and myosin light chain were measured by Western blotting of SDS-PAGE gels. Protein bands were quantified with the Image Quant software (GE Healthcare). Analysis of variance (ANOVA) was performed with the software Minitab (Version 17.2.1).

Results

There was no difference ($p > 0.05$) in the pH values, which was in the range 5.55 to 5.62 (s.d 0.04), of the 6 *semitendinosus* muscles used in this study. Marinade A and C had pH-values of 6.38 and 6.45 respectively after addition of muscle, which were higher ($p < 0.001$) than the corresponding values for marinade B and D which were 5.49 and 5.52. The muscle slices injected with marinade A had 34.0 (s.d 8.8) N cm⁻² as average WB shear force value, which was lower ($p < 0.05$) than slices injected with marinade D (49.0 N cm⁻², s.d 8.8). Average WB values for the samples injected with marinade B and C were 44.7 (s.d 10.4) and 40.3 (s.d 5.2) N cm⁻² respectively, and these were neither different from marinade A or D. Both desmin and myosin light chain were increasingly degraded with time ($p < 0.001$), but no difference was found between the marinades A-D at each of the 3 time periods.

Conclusion

This study has shown that actinidin has a tenderizing effect on bovine *semitendinosus* muscles. The proteolytic activity seems to be higher when pH is around 6.4 than 5.5. Since no differences were seen in degradation rate of desmin and myosin light chain between the 4 marinades, the proteolytic activity of actinidin is limited against these proteins.