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Exogenous HSP27 protects troponin-T degradation in postmortem beef muscles by decreasing caspase-3 activity (#216)

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Introduction

Heat shock protein 27 (HSP27) is believed to be an indicator of myofibrillar protein degradation and tenderness. The levels of HSP27 and its fragments can explain up to 91% of variation in sensory scores, exceeding the predictive value of succinate dehydrogenase. However, the exact mechanism of HSP27 involved in tenderization is not fully illuminated. The objective of this study was to elucidate this mechanism through examination of the influence of exogenous HSP27 on the degradation of Troponin-T over storage time in PM meat via interactions with caspase-3.

Methods

The longissimus thoracis (LT) muscles were excised from the carcasses within 30 min. After removal of visible fat and connective tissue, the minced muscle was soaked in 100 mmol/L NaCl with or without 15 mmol/L HSP27 (Enzo, New York, USA) for 0.25, 1, 3, and 5 d at 4°C. At the end of each storage period, the samples were individually obtained and rapidly frozen in liquid nitrogen until further analysis.

Results

The 28–30-kDa polypeptides from troponin-T were detected on after incubation of bovine muscle for various times. As shown in Figure 1, two closely spaced bands of intact troponin-T (TnT-1, TnT-2) and two bands of degraded troponin-T (tnt-1, tnt-2) were detected. In contrast to the 0-d samples, samples incubated without HSP27 for 0.25, 1, 3 and 5 d showed an increase in the level of the tnt-1 band. By contrast, the intensity of tnt-2 expression reduced in samples incubated with HSP27 for 0.25 d, with no difference from the control groups at 3 or 5 d.

The activity of caspase-3 increased initially in the PM meat and then decreased rapidly, reaching its maximum at 0.25 d PM (Figure2 (a)). With the addition of HSP27, the activity of caspase-3 gradually decreased, with no upward trend detected over time. Overall, the activity of caspase-3 in the HSP27-treated meat samples was lower than that in meat without HSP27. Meanwhile, the level of caspase-3 degradation was lower in the HSP27-treated group than in the control group at both 0.25 d and 1 d PM; the active fragment of 23 kDa was detected in the first 5 d PM, but was lower than that at the previous time point(Figure2 (b)).

Conclusion

Exogenous HSP27 inhibited the degradation of troponin-T and the production of its fragments, and reduced the activity and the degradation of caspase-3. Therefore, HSP27 may indirectly mediate the postmortem proteolysis of muscle proteins via reducing the activities of caspase-3 to affect postmortem meat tenderness.

Notes

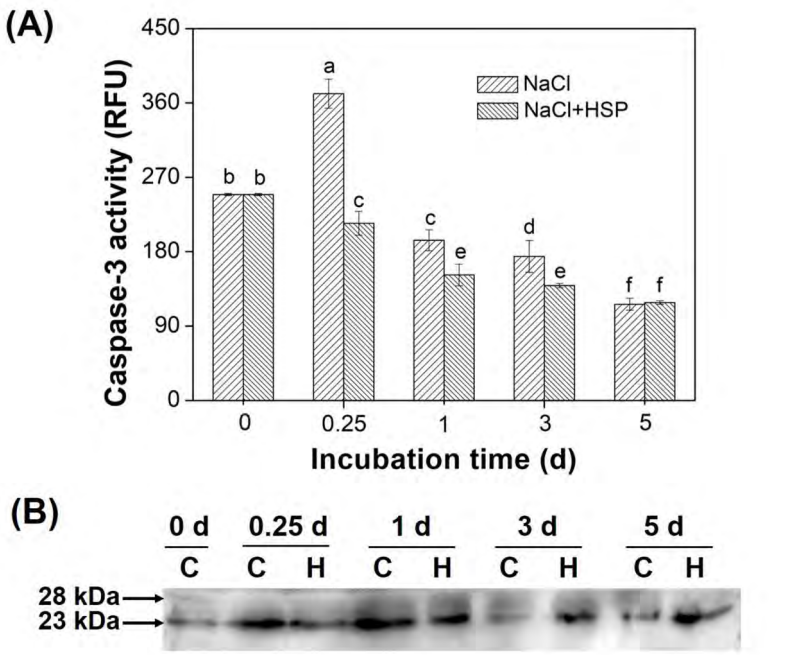

Figure 2 Effect of exogenous HSP27 on caspase-3
(a) Densitometric analysis of caspase-3 activity during PM storage of beef muscles incubated with or without HSP27 for 0, 0.25, 1, 3, 5 d. Bars labelled with different letters differ at the 95% level.
(b) Representative Western blotting patterns showing the change of caspase-3 from beef muscle incubated with or without HSP27 for 0, 0.25, 1, 3, 5 d. C: Control, H: HSP27.

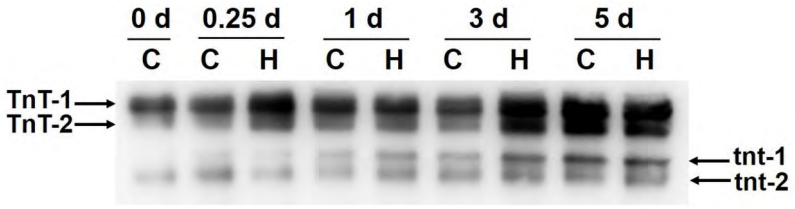

Figure 1 Effect of exogenous HSP27 on troponin-T degradation
Representative Western blotting patterns showing the change of troponin-T from beef muscle. C: Control, H: HSP27, TnT-1, TnT-2: two bands of intact troponin-T, tnt-1, tnt-2: two degradative bands of troponin-T.

Notes