PLECTIN POSTMORTEM DEGRADATION AND ITS RELATION TO WATER DISTRIBUTION IN FRESH PORK

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I. OBJECTIVES

Plectin is an intermediate filament (IF)-based versatile cytolinker protein of the plakin family. Plectin links the desmin IF and anchors them to specific cytoskeletal structures and cytoplasmic organelles in skeletal muscle, forming a complex IF network that has a great influence in sustaining and strengthening the integrity of cytoarchitecture. A previous study has shown that plectin was a potential substrate of calpain-1 during the conversion of muscle to meat. Therefore, the current study aimed to evaluate the contribution of plectin postmortem degradation to the changes in water distribution in fresh pork.

II. MATERIALS AND METHODS

Longissimus thoracis muscles (between the 10th and 14th thoracic vertebra with the size of 15 cm × 8 cm × 4 cm) were collected from both sides of 44 carcasses within 1 h postmortem and aged at 4°C for 0 h, 6 h, 12 h, 1 d, 3 d, 7 d, and 13 d under vacuum package. *Longissimus thoracis* samples from one side were used to prepare the whole protein samples of 5 mg/mL for the Western blot analysis of plectin degradation. Samples from the other side were used for low field-nuclear magnetic resonance analysis (LF-NMR) based on the spin-spin transverse relaxation time (T_2) analysis. Statistical significance of the differences among individual means was assessed by Duncan's multiple-range tests. Pearson correlation coefficients were obtained to evaluate the correlation between different protein degradation and LF-NMR parameters.

III. RESULTS

Figure 1 shows that plectin was found to be significantly degraded during postmortem aging. The amount of intact plectin was rapidly reduced at the early postmortem aging ($P < 0.05$) and almost disappeared at day 3. Meanwhile, the degraded plectin under the intact band emerged at 0 h and accumulated fast during the first 3 d aging ($P < 0.05$). However, the amount of the degraded product reduced between day 3 and day 13 ($P < 0.05$), indicating a further degradation of plectin during later stage of postmortem aging. Table 1 shows the correlations between LF-NMR T_2 parameters (water population [P] and transverse relaxation time [T]) and plectin postmortem degradation. The amount of intact plectin during 1-d aging was significantly correlated to P_{21} at day 1 and 3 ($P < 0.01$). There were significantly positive correlations between plectin intensity within 1 d and P_{22} at 1 d and 3 d ($P < 0.01$). Moreover, plectin content at 0 h was significantly correlated to T_{21} and T_{22} at 1 d ($P < 0.01$). As P_{21} and P_{22} represent the intra- and extra-myofibrillar water, respectively, these results indicate that plectin might contribute to the water distribution during condition including the decrease of intra-myofibrillar water and the increase of extra-myofibrillar water early postmortem. As T_{21} and T_{22} reflect the changes in intra- and extra-myofibrillar space, the results above imply the contribution of plectin to the structural changes including the decrease of intra-myofibrillar space and the space between myofibrils and sarcolemma early postmortem.

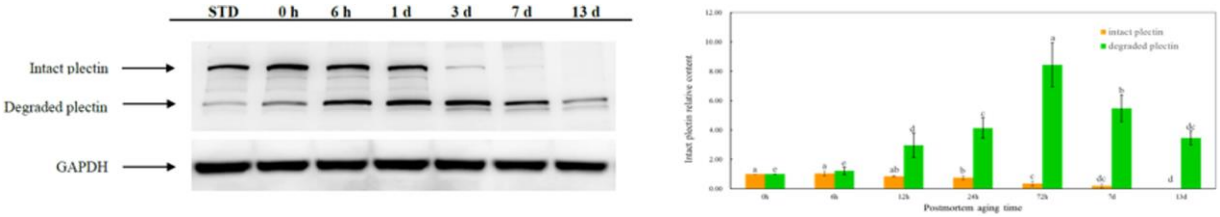

Figure 1.
Western blot analysis of plectin expression in postmortem pork LT muscle.
Note: 50 μg of total protein samples was loaded per lane. The standard was a sample with a stable band in the trial test and was loaded onto each gel

Table 1
Pearson correlation coefficients and levels of significance for the correlations between plectin degradation and LF-NMR T21, T22, P21, P22.

	P_{21}				P_{22}				T_{21}				T_{22}			
Intact plectin	**1d**	**3d**	**7d**	**13d**	**1d**	**3d**	**7d**	**13d**	**1d**	**3d**	**7d**	**13d**	**1d**	**3d**	**7d**	**13d**
0h	-0.549**	-0.500**	-0.421**	-0.002	0.576**	0.544**	0.551**	0.386**	-0.445**	-0.119	-0.031	-0.264	-0.415**	0.026	-0.253	-0.338*
6h	-0.404**	-0.394**	-0.051	-0.117	0.428**	0.406**	0.269	0.275	-0.172	0.133	0.022	-0.239	-0.322*	-0.029	-0.195	-0.187
1d	-0.486**	-0.380*	-0.246	-0.070	0.480**	0.414**	0.409**	0.310*	-0.230	-0.142	-0.058	-0.238	-0.350*	0.052	-0.221	-0.198
3d	-0.549**	-0.338*	-0.354*	0.043	0.566**	0.425**	0.421**	0.118	-0.431**	-0.182	-0.034	-0.145	-0.466**	0.116	-0.140	-0.054

- Note: **: Correlation is significant at the 0.01 level. *: Correlation is significant at the 0.05 level. (n=44).

IV. CONCLUSION

Plectin degradation was found to be negatively correlated to P_{21}, T_{21}, and T_{22} and positively correlated to P_{22}. The correlations were established between plectin content at the earlier aging time and the population of T_2 water at the later days, indicating the potential contribution of plectin degradation to the changes of water distribution during postmortem aging.
Keywords: plectin, pork, postmortem aging, water-holding capacity