EFFECT OF SMALL HEAT SHOCK PROTEINS EXPRESSION AT THE EARLY POSTMORTEM PERIOD ON SENSORY QUALITY TRAITS IN HANWOO STEERS

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I. INTRODUCTION

Small heat shock proteins (sHSPs), including HSP20 and HSP27, are the molecular chaperone, and play important roles in myofiber maintenance and repair of living animals and apoptotic processes during the postmortem period [1]. Thus, expression level of sHSPs in sarcoplasmic fraction during aging is associated with the tenderization of cooked beef, due to its protective effect on protein fragmentation [1]. Moreover, extent of sHSPs degradation in myofibrillar fraction was also related to tenderness [2]. The aim of this study was to investigate the effect of sHSPs expression at the early postmortem period on the objective tenderness parameter and sensory quality traits of the Hanwoo steers in order to provide predictor or indicator for tenderness of cooked beef.

II. MATERIALS AND METHODS

A total of 10 Hanwoo steers were used. At 45 min postmortem, the muscles were sampled from the 13th thoracic vertebrae of *longissimus thoracis* muscle for western blot analysis. After 24 h chilling, marbling score (1 to 9; devoid to very abundant) was evaluated [3], and then loins were taken from the 10 to 13th thoracic vertebra to determine the Warner-Bratzler shear force (WBS) using an Instron Universal Testing Machine (Model 1011, Instron Corp., USA). Sensory quality traits were evaluated by eleven trained sensory panelists [4]. For western blotting assays, sarcoplasmic and myofibrillar fractions were extracted, and the anti-HSP20 and anti-HSP27 were used as primary antibody (Santa Cruz Biotechnology Inc., USA). Each protein band intensity was measured by image analysis software (Eastman Kodak Company, USA). Cluster analysis was conducted by the SAS software [5] to classify the samples into groups of WBS value (groups low and high).

III. RESULTS AND DISCUSSION

As expected, value of WBS was greater in the WBS-high group compared to the WBS-low group ($P < 0.001$), although no significant difference was observed in marbling score between the groups ($P > 0.05$; Table 1). Moreover, the low group exhibited higher values in tenderness attributes than the high group ($P < 0.05$) with the exception of perceptible residue amount ($P > 0.05$).

Table 1. Comparison of marbling score, Warner-Bratzler shear force (WBS), and sensory quality characteristics of cooked beef in the groups classified by WBS value

	WBS group		SE	Level of significance
	Low	High		
Marbling score	6.60	7.00	0.17	NS
WBS (N)	47.5[b]	65.5[a]	1.98	***
Sensory quality characteristics				
Softness[1]	7.11[a]	5.58[b]	0.26	**
Initial tenderness[2]	7.20[a]	5.68[b]	0.20	***
Chewiness[3]	6.77[a]	5.25[b]	0.30	**
Rate of breakdown[4]	6.16[a]	4.92[b]	0.20	**
Amount of perceptible residue[5]	6.16	5.72	0.15	NS
Juiciness[6]	5.91[a]	5.21[b]	0.14	**
Flavor intensity[7]	5.87[a]	5.26[b]	0.11	**

Level of significance: NS = not significant; ** $P < 0.01$; *** $P < 0.001$. [a-b]Least square means with different superscripts in the same row significantly differ ($P < 0.05$). Scale: 1 to 9, low to high; [1]very hard to very soft; [2]very tough to very tender; [3]very chewy to very tender; [4]very slow to very fast; [5]abundant to none; [6]not juicy to extremely juicy; [7]very weak to very strong.

Expression of different sHSPs at the early postmortem period are graphically presented in Figure 1. The WBS-low group exhibited significantly lower levels of HSP20 and HSP27 expression in sarcoplasmic fraction compared to the WBS-high group ($P < 0.05$). Higher expression levels of chaperon proteins in the WBS-high group could be explained by a previous finding [1], who reported that delayed fragmentation of cytoskeletal proteins is associated with higher expression levels of sHSPs, and thus affecting tenderness of cooked beef. However, there were no significant differences in the expression levels of HSP20 and HSP27 in myofibrillar fraction between the groups ($P > 0.05$).

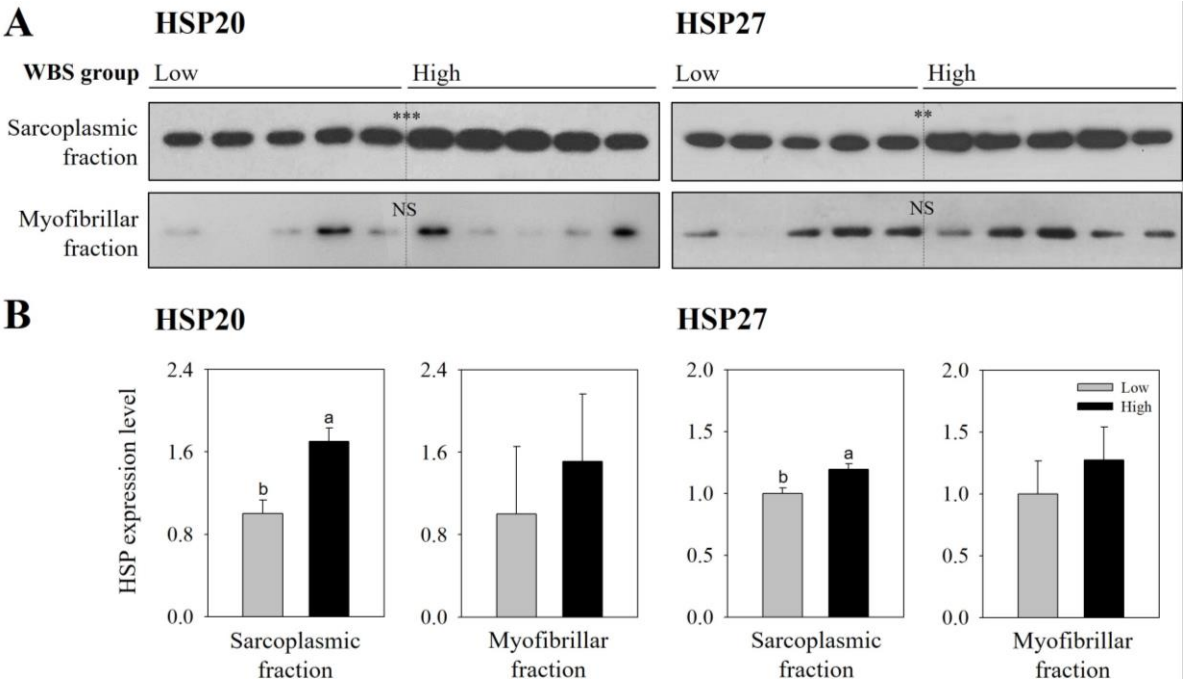

Figure 1. Western blot images (A) and expression levels (B) of different small heat shock proteins (sHSPs) in sarcoplasmic and myofibrillar fractions of the *longissimus thoracis* muscle at the early postmortem period in the groups classified by Warner-Bratzler shear force (WBS) value. Level of significance: NS = not significant; ** $P < 0.01$; *** $P < 0.001$. Bars indicate SE. Different letters denote significant differences ($P < 0.05$).

IV. CONCLUSION

Our results implied that the expression levels of HSP20 and HSP27 in sarcoplasmic fraction at the early postmortem period could be considered as predictor or indicator for tenderness attributes of cooked Hanwoo steers.

ACKNOWLEDGEMENT

This research was supported by the National Research Foundation of Korea (NRF-2017R1D1A3B03029840).

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