PE4.91 Effects of Electrical Stimulation on Warnar-Braztler Shear Force of Hanwoo Loin (M. Longissimuss dorsi) with Various Intra-muscular Fat Levels 321.00

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Abstract: Objective of this study was to investigate the effects of electrical stimulation on Warnar-Braztler shear force and sensory property of M. longissimus dorsi from Hanwoo beef with various intra-muscular fat levels. Eighty six Hanwoos (58 cows and 28 steers; ~72 months old) were slaughtered in the abattoir, located at NIAS (National Institute of Animal Science). During bleeding, laboratory-made electrical stimulator was used for the experiment, and ES (AC, 80V for 60sec + DC, 80V for 60sec) was applied. Fat levels (IMFLs) were equally grouping with into four levels based intra-muscular fat. Two lower IMFLs(1, 2) from Non-ES had a significantly different than two higher IMFLs(3, 4) and all four IMFLs from ES can not be used effectively in the difference of WBsf, tenderness, flavour and overall acceptability. Also tenderness, flavour and overall acceptability scores showed that each treatment group (ES, Non-ES) from IMFL1 and IMFL2 was significantly different when compared four IMFL levels, but at over IMFL3 did not show any significant difference.

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Index Terms:Hanwoo, Electrical stimulation, Intra-muscular fat level, WBsf, Sensory.

I. INTRODUCTION

M anagement to improve beef tenderness is always been a historical idea, and it has become an issue of prime importance to the meat scientist and industries as well. Variation in tenderness is the prime explanation for consumer¡¯s dissatisfaction for meat. Electrical stimulation technique has been used in many countries to improve carcass quality as well as eating quality. Also a number of studies demonstrated that cold shortening is not a concern for highly fattened cattle such as long term-grain-fed Hanwoo [1] and proved tenderization for low fattened Hanwoo cow[2]. Thus, the objective of this study was to evaluate that the effect of electrical stimulation of tenderization and sensory property of longissimus dorsi muscle of Hanwoo with different intra muscular fat levels.

II. MATERIALS AND METHODS

A total of 86 Hanwoo cattles (58 cows and 28 steers; ~72months old; live weight ~552kg) were obtained from the NIAS and slaughtered in the abattoir at NIAS. During bleeding, fifty five animals were electrically stimulated via Achilles tendon probes (AC, 80V for 60sec + DC, 80V for 60sec; ave. 155mW) by laboratory-made electrical stimulator (ELV, VMT Co., LTD., South Korea). The carcasses were chilled at 4¡æ during 24h, and the M. longissimus lumborum were deboned and packed in polyethylene bag. The samples were stored at 4¡æ in the chilling room and used for analysis after the following day. Water-holding Capacity (WHC) was determined [3]. The quality grade of beef was evaluated by Korean carcass grading system of Animal Product Grading Service (Korea). Warner-Braztler shear force (WBsf) measurements were 1.27 cm circular core to determine sheared by cooked steaks (2.5 cm thick). Eight cores were made for each sample, and peak force determined using a Instron (model 4465, Instron crop., UK) with a load cell 50 kg and head speed 200mm/min. Sensory property was evaluated for tenderness, juiciness and flavour intensity using eight-point descriptive scales.

Fat levels were equally grouping into four levels based intra-muscular fat contents (%, IMFL: "1" ≤ 5.55; 5.55<"2"≤7.40; 7.40<"3"≤11.54; 11.55≤"4"). Pooled data were analyzed using the General Linear Models (GLM) of the Statistical Analysis System [4].

III. RESULTS AND DISCUSSION

The WBsf, WHC and the quality grade of Hanwoo beef with different intramuscular fat levels were shown in Table 1. Two lower IMFLs(1, 2) beef samples for non-ES had significantly higher WBsf values than two higher IMFLs($p<0.001$) samples. The result of this study indicated that increase of IMFL decreased WBsf values while effect of electrical stimulation on tenderization was not significant. Also, sensory scores of tenderness, juiciness, flavour-likeness and overall acceptability were significantly higher for high IMFL samples than those for low IMFL samples, whereas there was no significant difference in all IMFL samples applied ES treatment (Table 2). Overall WBsf values and sensory properties of ES beef samples were higher when compared to those of non-ES beef sample. The sensory property of beef samples treated by electrical stimulation is shown in Fig 1.

IV. CONCLUSION

This study has shown that ES treatment improved the beef quality, however, the lower IMFLs (1, 2) had more significantly effective in WBsf and sensory properties of tenderness, flavour and overall acceptability than two higher IMFLs (3, 4) for Hanwoo beef.

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Table 1. Comparison of WBsf, WHC, meat quality grade of *M. longissimus dorsi* from Hanwoo by different intra-muscular fat level with non-ES and ES

Item	Treat	IMFL* 1	IMFL 2	IMFL 3	IMFL 4	STD dev	coefficient	Prob.
WBsf(kg)	Non-ES**	8.89^{a}	7.74^{ab}	5.58^{bc}	4.81^{c}	4.10	-0.5685	
	ES**	4.65^{ab}	5.06^{a}	4.45^{ab}	3.45^{b}	1.84	-0.2095	
WHC	Non-ES	51.74	55.12	53.54	55.2	0.62	0.2258	
	ES	54.54	52.74	54.58	54.1	3.17	-0.0200	
Meat quality grade***	Non-ES	0.57^{b}	1.25^{b}	1.63^{b}	3.2^{a}	1.49	0.6969	<.0001
	ES	0.83^{c}	1.25^{bc}	1.67^{b}	2.78^{a}	1.11	0.6188	<.0001

a-c Means with different letter in the same column are significantly different between intra-muscular fat levels
*IMFL; Intra muscular fat level(%): "1" ≤ 5.55; 5.55<"2"≤7.40; 7.40<"3"≤11.54; 11.55≤ "4"
* *Non-ES : No electrical stimulation, ES : AC, 80V, 60sec+DC, 80V, 60sec.
***Beef quality grade of Korea Animal products grading Service' 1^{++}'=5, '1^{+}'=4, '1'=3, '2'=2, '1'=3

Table 2. Sensory Properties of *M. longissimus dorsi* from Hanwoo by different intramuscular fat levels on non-ES and ES (unit:Score)

Item	Treat	IMFL* 1	IMFL 2	IMFL 3	IMFL 4	STD dev	coefficient	Prob.
Tenderness [1)]	Non-ES*	3.28^{b}	3.4^{b}	5.13^{a}	6.19^{a}	0.30	0.6876	<.0001
	ES*	4.77	4.95	5.04	5.5	0.84	0.2960	
Flavour [2)]	Non-ES	4.56^{b}	4.94^{b}	5.87^{a}	6.39^{a}	1.75	0.8012	<.0001
	ES	5.47	5.6	5.82	4.95	1.06	-0.1261	
Juiciness [3)]	Non-ES	5.46^{bc}	5.29^{b}	6.03^{ab}	6.66^{a}	0.92	0.6454	
	ES	5.64^{b}	5.68^{b}	5.81^{ab}	6.11^{a}	0.44	0.3808	
Overall Acceptability [4)]	Non-ES	3.76^{b}	3.83^{b}	5.46^{a}	6.33^{a}	0.78	0.7189	<.0001
	ES	5.06	5.2	5.51	5.5	0.70	0.2618	

a-c Means with different letter in the same column are significantly different between intra-muscular fat levels
*IMFL; Intra muscular fat level(%): “1” ≤ 5.55; 5.55<“2”≤7.40; 7.40<“3”≤11.54; 11.55≤ “4”
**Non-ES : No electrical stimulation, ES : AC, 80V, 60sec+DC, 80V, 60sec.
[1)] Tenderness : 1 = Extremely tough, 8 = Extremely tender.
[2)] Flavour : 1 = Extremely bland, 8 = Extremely intense.
[3)] Juiciness : 1 = Extremely dry, 8 = Extremely juicy.
[4)] Overall acceptability : 1 = Extremely bad, 8 = Extremely good.

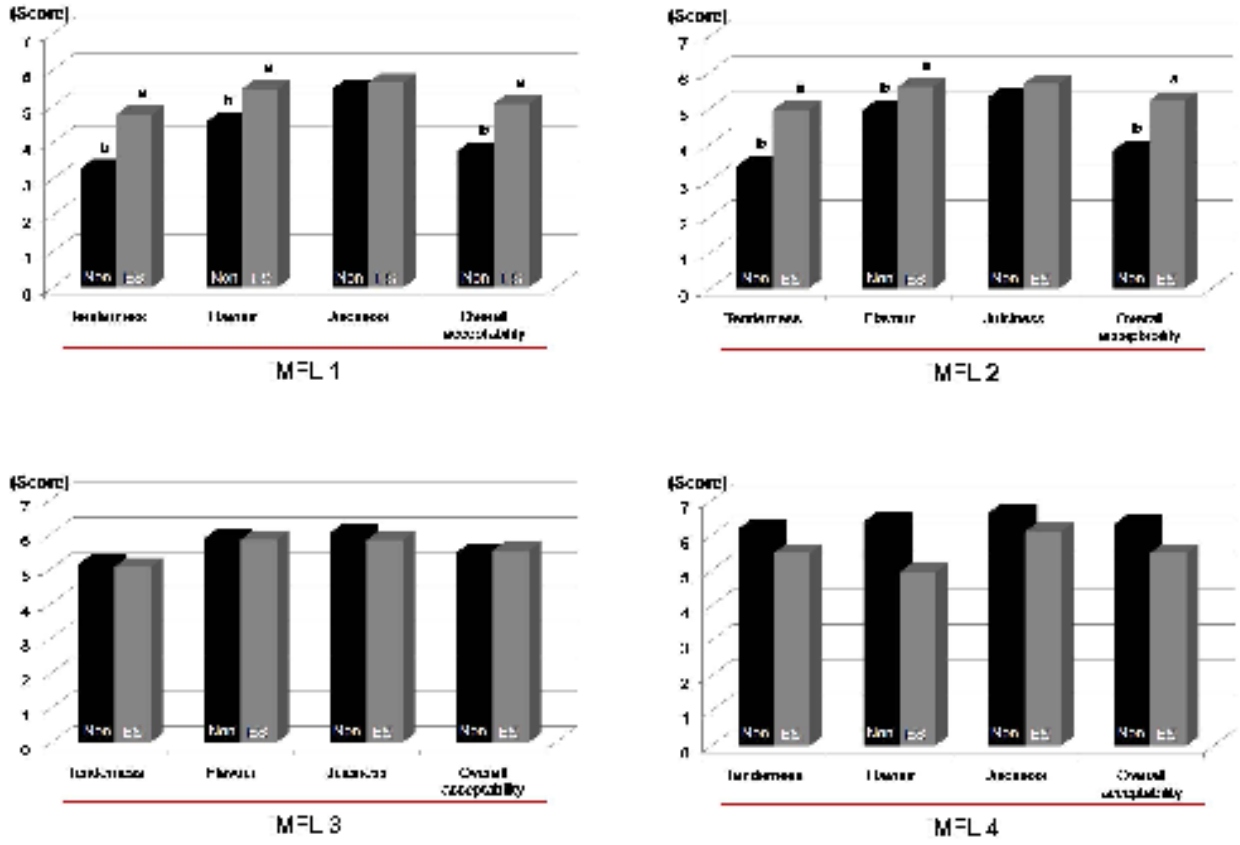

Fig 1. Comparison of sensory properties of *M. longissimus dorsi* from Hanwoo by electrical stimulation treatment on different intramuscular fat levels (IMFL). Unit; score, ES (AC, 80V, 60sec, DC, 80V, 60sec) Non-ES-ES, Item (same as the Table 2), IMFL (Intra muscular fat level(%); “1” ≤ 5.55; 5.55<“2”≤7.40; 7.40<“3”≤11.54; 11.54≤ “4”), Non-ES (No electrical stimulation), ES (AC, 80V, 60sec, DC, 80V, 60sec), a-b Means with different letter in the same intra-muscular fat levels are significantly different between ES and non-ES($p<0.05$).