MEAT QUALITY TRAITS, COLLAGEN CONTENT AND CALPAIN OF DRY AGED HANWOO BEEF

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I. INTRODUCTION

During the conversion of muscle to meat and subsequent ageing, μ-calpain is considered to be the greatest contributor to the proteolytic process of the architecture-associated proteins of the myofibril [1]. Collagen, as the main component of muscle connective tissue, is important for texture and processing quality of meat, especially for meat tenderness and water-holding capacity. The present study aimed at characterizing the action of collagen type I and III and Calpain in different dry aged beef muscles. The results of the present study could provide a better understanding of the contribution of collagen type I Type III and calpain to protein degradation of dry aging beef.

II. MATERIALS AND METHODS

Different muscles: *Longissimus lumborum* (LL), *Triceps brachii* (TB), *Biceps femoris* (BF), Hind shank (SN), *Diaphragm* (DP) and *supraspinatus* (SS) of Hanwoo cow (n=162) were applied for dry aging. Three different aging conditions used were:(i): all muscles at 0d and 20d aged at 2°C and 65% air humidity; (ii): all muscles at 40d aged at 2°C and 75% air humidity; (iii): all muscles at 60d and 90d aging at 4°C and 85% air humidity. Two groups used were: the natural drying condition (T5); and inoculated with *deebaryomyces hansenii* and *penicillium candidum* on muscles surfaces (T6). Collagen Type I and Type III extraction and SDS-PAGE were performed using the methods of Murialidharan and Laemmli [2,3]. Casein zymography was performed by the methods of Veiseth et al[4].

III. RESULTS AND DISCUSSION

No differences in recovery and ratio occurred among the aging time groups. But collagen type I and type III abundance decreased as increasing aging for the two groups (Fig. 1 1-1&1-2 $P<0.05$). After 40d aging, the recovery with collagen Type I and III in DP muscle were higher than in the others (Fig.1 1-3 & 1-4). μ-calpain tended to decrease during aging for all muscles in the two groups. But the degradation was different, especially DP showed the slowest. μ -calpain was disappeared after 90d (Fig. 2). Significant differences ($P<0.01$) in intact μ-calpain occurred among the aging times for all the muscles.

Differences ratio between collagen type I and type III may be attributed to the *deebaryomyces hansenii* and *penicillium candidum* which caused the different degradation rate of collagen Type I and III during the dry aging periods. μ-calpain in DP muscle showed the slowest degradation, while simultaneously the recovery of collagen Type I and III showed higher in DP muscle than other muscles at 40d. It may be suggested that the degradation of μ-calpain could affect the recovery of collagen Type I and III.

Table 1. Collagen Type I Type III and calpain traits as a function of aging parameters and muscle type

		T5							T6					
		0d	20d	40d	60d	90d	SEM	F. value	0d	20d	40d	60d	SEM	F. value
BF	recovery	0.37a	0.17b	0.23b	0.25ab	0.25ab	0.07	3.33	0.2	0.2	0.29	0.25	0.04	0.82
	ratio	5.37ab	3.15b	3.41b	8.08a	6.02ab	2.02	3.31	3.08	6.02	4.19	5.3	1.29	1.87
	calpain1	70.13a	14.4b	.	.	.	39.4	9.99**	37.2	13.4	.	.	16.83	5.02*
	calpain	29.87	52.27	.	33.33	.	12.1	1.17	62.8a	19.93b	.	.	30.31	7.57*
DP	recovery	0.27b	0.45ab	0.35ab	0.39ab	0.53a	0.1	2.4	0.46	0.35	0.43	0.31	0.07	0.31

	ratio	3.81ab	3.28ab	5.27a	4.33ab	2.98b	0.91	2.25	5.68	7.43	3.53	3.79	1.82	1.69
	calpain1	100a	86a	56.3b	24.83c	.	33.4	30.02***	100a	71.87ab	63.4b	36.37b	26.21	6.15*
	calpain	43.97	41.83	33.33	14	.	13.65	1.07	.	28.13	30.3	36.6	4.4	3.05
LL	recovery	0.15	0.21	0.28	0.15	0.18	0.05	1.39	0.2	0.15	0.19	0	0.05	0.62
	ratio	4.78	3.83	4.75	4.96	3.91	0.53	0.44	6.86	4.84	5.48	4.4	1.07	1.17
	calpain1	97.53a	14.67b	.	.	.	58.59	40.75***	100a	45.33b	.	.	38.66	10.94**
	calpain	2.47	18.67	.	.	.	11.46	0.94	21.33	.	.	.	.	1.07
SN	recovery	0.48	0.3	0.36	0.3	0.31	0.08	0.23	0.18	0.28	0.17	0.17	0.05	0.23
	ratio	6.53	5.42	4.94	7.93	4.64	1.35	0.77	4.69	3.55	5.75	6.03	1.13	0.77
	calpain1	96.07a	51.2b	17.17c	13.8c		38.27	17.94***	100a	62.1ab	36.3bc	.	32.04	9.52**
	calpain	3.93b	48.8a	86.2a	49.5a	.	33.67	6.77**	.	37.9	63.7	33.33	16.38	1.47
SS	recovery	0.27	0.33	0.33	0.36	0.27	0.04	0.44	0.31	0.33	0.18	0.19	0.08	1.36
	ratio	6.21	4.84	9.16	7.64	3.51	2.23	1.45	6.21ab	5.84ab	12.93a	4.66b	3.74	2.93
	calpain1	90.03a	16.63b	17.77b	11.53b	.	37.46	9.68**	72.63a	69.5a	34.83ab	.	20.98	6.55*
	calpain	9.97	50.37	48.9	21.8	.	22.74	1.25	27.53	30.83	65.07	33.33	17.42	0.67
TB	recovery	0.67	0.51	0.35	0.35	0.18	0.19	1.2	0.47	0.38	0.27	0.25	0.1	0.66
	ratio	5.43	3.26	4.69	4.01	2.72	1.08	1.82	4.49	6.13	6.11	4.17	1.04	1.37
	calpain1	100a	70.58b	15.4c	.	.	42.95	58.32***	84.7a	71.3a	35.47ab	17.97b	30.97	3.91
	calpain	.	29.43	84.43	.	.	42.86	37.92***	15.3	28.7	48.7	64.53	21.7	1.26

df:5/14(T5), 5/11(T6); F. value *means P<0.05; **means P<0.01; ***means P<0.001; Means within same row with different letters are significantly different(P<0.05); Recovery: Collagen Type I and Type III abundance in the beef (mg/g); Ratio: the rate between Collagen Type I and Type III; calpain1: intact calpain(80KD); values in the table means the ratio between 80KD and 78KD; calpain means degraded calpain(78KD); (.): not found.

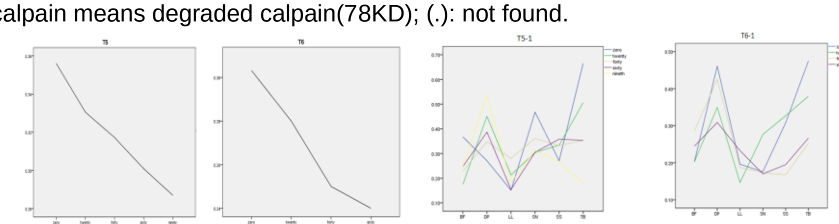

Fig.1-1 Fig.1-2 Fig.1-3 Fig.1-4

Figure 1. Collagen type recovery with different muscle and aging
1-1 and 1-2: means collagen type I and type III abundance of different aging in every group; 1-3 and 1-4: means collagen type I and type III abundance of different muscles and aging in every group.

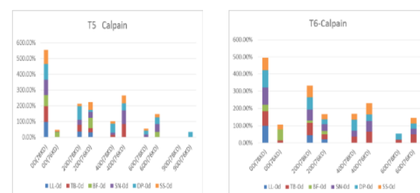

Figure 2. Degraded μ-calpain with different aging

IV. CONCLUSION

It is concluded that the amount of collagen type I type III and μ-Calpain activity were decreased as increasing aging time for all muscles in the two groups.

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