Effect of combining PEF treatment and drying conditions on weight loss and shear force of venison

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I. INTRODUCTION

Dry aging of meat generates unique flavours and added-value [1]. A main drawback of dry aging is the high weight loss during storage and the long process. The use of pulsed electric field treatment (PEF) and controlled relative humidity can improve mass transfer and enhance drying kinetics, leading to time savings and improved control over weight loss. This study investigated the drying rates of venison samples (control, low PEF and high PEF) dried at 4°C and either 65% or 80% relative humidity (RH). The effects of the treatments on some physicochemical properties, including shear force were determined.

II. MATERIALS AND METHODS

Venison loins (*M. longissimus et lumborum*, LL) were obtained from twelve 2 year old hinds (average cold carcase weight of 113 ± 6.7kg and 108 ± 9.8 kg over two slaughter days (6 carcases for 65% RH and for 80%RH, respectively). The left and right loins from each carcase were obtained at 24 h post-mortem and processed into blocks of average weight of 318 ± 11.6 g, avoiding any visible fat and connective tissue. The blocks were randomly distributed to wet-aged control, dry-aged control, wet-aged low PEF, dry-aged low PEF, wet-aged high PEF, and dry-aged high PEF [2]. Total specific energy was approximately 1.93 $kJ.kg^{-1}$ for LPEF (2.5 kV, 50 Hz and 20 µs) and 70.2 $kJ.kg^{-1}$ for HPEF (7.5 kV, 50 Hz and 20 µs). The first set of samples (n = 6) was dry aged in a chiller at 65% RH for 10 days, vacuum packed and stored for 11 days. The second set of samples (n = 6) was dry aged at 80% RH for 21 days at 4°C. Changes in pH, conductivity and purge, thaw cooking and total weight loss were determined as described by Khan et al. [2]. Weight loss and shear force were determined. Heated control samples incubated at 12°C similar high PEF for 10 min were run in parallel but no differences were found compared to non-treated controls and thus not reported.

III. RESULTS AND DISCUSSION

PEF treatment had an effect on pH and post-treatment conductivity in 80% RH ($p < 0.05$) samples but not 65% RH samples (Table 1). This is likely due to different processing between groups. Lower drip, purge and cooking losses, and higher initial weight loss were found in dry aged samples (Table 1). Weight loss in high PEF was greater than the control and than the low PEF in the 80% RH treated samples, and both PEF treated sample sets had higher weight loss than control in the 65% RH samples (Figure 1). For 80% RH, only dry aged high PEF samples had lower shear force values than wet aged control samples, whereas dry aged low PEF and wet aged high PEF had significantly lower shear force than wet aged control samples.

IV. CONCLUSION

The use of PEF and different RH drying can achieve modification of the meat texture and regulate the mass transfer of aged venison.

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REFERENCES

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Table 1. Effect of pulsed electric field (low intensity v high intensity), aging (dry v wet) and relative humidity (65% v 80%) on pH, conductivity and weight loss of venison

Treatment		pH			Conductivity σ (mS/cm)							
PEF	Aging	Pre-PEF pH	Post-PEF pH	Post-Age pH	Pre-PEF Conductivity σ (mS/cm)	Post_PEF Conductivity σ (mS/cm)	Post-Age conductivity σ (mS/cm)	Initial loss (%)	Purge loss (%)	Thawing loss (%)	Cooking loss (%)	Total weight loss (%)
80%RH												
control	Wet	5.74	-	5.75ab	8.37	-	12.22	3.81c	1.80a	1.62bc	23.67a	31.19
	Dry	5.71	-	5.79ab	8.85	-	11.67	23.75b	0.65b	0.93bc	11.05b	36.39
Low	Wet	5.70	5.69ab	5.74b	8.60	10.70ab	12.07	3.92c	2.04a	1.97b	24.30a	32.22
	Dry	5.71	5.72a	5.81a	8.88	10.35b	12.42	25.85ab	0.92b	0.50c	6.31b	33.67
High	wet	5.70	5.64b	5.74b	8.13	11.62a	12.38	3.98c	2.09a	1.60bc	25.47a	33.14
	dry	5.68	5.65b	5.78ab	8.52	12.05a	11.40	28.47a	0.96b	0.65c	7.86b	37.94
	SEM	0.02	0.02	0.01	0.68	0.42	0.30	0.60	0.07	0.23	1.56	1.91
65%RH												
Control	Wet	5.62		5.67	9.97		12.70	5.87c	2.03a	2.90a	34.33a	45.15b
	Dry	5.61		5.67	9.87		12.65	23.92b	0.67b	0.62b	26.85bc	52.05ab
Low	Wet	5.62	5.58	5.69	11.87	12.25	12.77	5.42c	1.99a	4.13a	33.73ab	45.26b
	Dry	5.58	5.58	5.69	11.80	12.28	12.58	29.48a	0.85b	0.71b	22.80c	53.80a
High	wet	5.59	5.58	5.67	11.38	12.42	12.82	6.63c	2.15a	2.28a	34.22a	45.27b
	Dry	5.59	5.53	5.69	9.87	11.25	12.65	30.20a	0.79b	0.27b	20.84c	52.10ab
	SEM	0.02	0.04	0.02	0.73	0.47	0.30	0.92	0.07	0.48	1.63	1.65

abc Figures with different letter in a column are significant different (at $p < 0.05$)

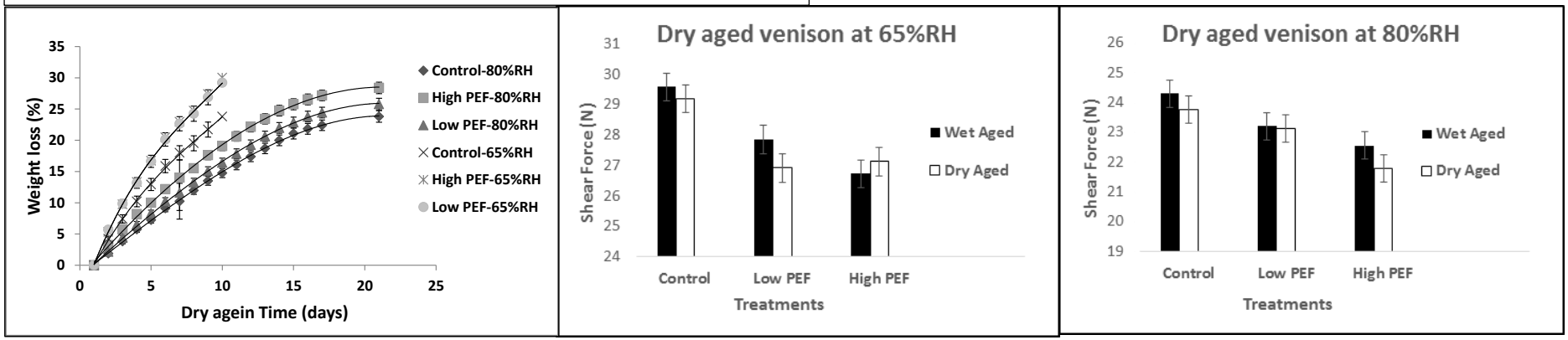

Figure 1. Effect of pulsed electric field intensity, aging (dry v wet) and relative humidity (65% v 80%) on weight loss (%) and shear force of venison.