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SEASONAL VARIATION AND MUSCLE TYPE INFLUENCE PORK QUALITY ACROSS THREE AUSTRALIAN SUPPLIERS

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I. INTRODUCTION

Fluctuation between seasons, in both temperature and humidity, is known to influence pork quality variation [1]. Pigs are more susceptible to high environmental temperatures than other livestock species, due to the lack of functional sweat glands. With limited ability for thermoregulation, extreme ambient temperatures during the period from farm to slaughter can result in critical changes in pigs, which can have implications for development of meat quality post-mortem [2]. Australia has a diverse range in temperature between hot and cold seasons and Australian pig production is generally located in areas with high summer temperatures [3]. Ambient temperature higher than the thermo-neutral zone is likely to cause heat stress in pigs, which can affect their response to pre-slaughter stressors, and produce meat with poor quality, such as high drip loss and paleness [1]. To understand the role of season in meat quality variation between muscles, the seasonal effect on water holding capacity and colour across three Australian supply chains was investigated.

II. MATERIALS AND METHODS

A total of 215 female pigs aged about 23 weeks, and sourced from both terminal and maternal lines, were selected from three farms (A, B and C) across two temperature seasons (hot: February 2023 – March 2023/2024, n = 111; cold: July 2023 – September 2023, n = 104). Average daily maximum and minimum temperature for the month of slaughter were recorded for each suppliers location for the month of slaughter (Table 1). The pigs were slaughtered under commercial conditions in the processing plants of the suppliers. At 24 h post-mortem, carcasses were boned. *Biceps femoris* (BF), *Longissimus thoracis et lumborum* (LTL) and *Triceps brachii* (TB) were collected from the carcasses and vacuum packed for 1 day ageing. Meat samples were transported to the University of Melbourne under refrigerated conditions. For all muscles the following measurements were made. Ultimate pH was measured at 48h post-mortem using a TPS WP-80 portable pH meter equipped with a TPS pH sensor and a temperature compensation probe (TPS Pty Ltd., Brisbane, QLD, Australia) and calibrated in pH 4.01 and 7.01 buffer. Drip loss was measured using the EZ-DripLoss method (weight loss over 48 h at 0-2°C, % of initial weight). Cook loss samples (55±5g) were cooked to an internal temperature of 70°C, cooled and cook loss was calculated from weight loss after cooking, expressed as % of initial. After blooming for 30 min at 0-2°C, colour was measured on the cut surface of a 2 cm thick steak using a Minolta CR-400 colorimeter (Konica Minolta INC., Tokyo, Japan; aperture diameter = 8 mm, illuminant D65, observer 2°, calibrated with white tile). Statistical analysis was performed using GenStat (22nd Edition, VSN International, Hemel Hempstead, UK) with Restricted Maximum Likelihood (REML) analysis [Fixed model = season + line + muscle + season.line + season.muscle + line.muscle (effects of line not reported); Random model = carcass number].

Table 1 – Average daily maximum/minimum temperature for the month of slaughter, for each supplier (A, B, C), during hot and cold seasons.

	Hot season	Cold season
A	32.2°C/17.2°C	20.0°C/5.7°C
B	27.5°C/11.0°C	12.7°C/2.0°C
C	24.2°C/14.0°C	16.6°C/7.7°C

III. RESULTS AND DISCUSSION

Season affected the surface redness for pork produced for all three suppliers ($P < 0.05$). Cold season pork had a lower redness, whereas the effect of season on ultimate pH and paleness was observed only for suppliers A and C ($P < 0.05$). Although no main effect of season was found on drip loss ($P > 0.05$), higher drip loss for LTL was observed in the cold season than hot season for suppliers B and C, whereas BF from supplier B had higher drip loss in the hot season ($P < 0.01$) which might be associated with the muscle temperature early post-mortem. Cook loss was affected by the interaction of season and muscle for all suppliers ($P < 0.05$). Cook loss of the TB for supplier A was higher in hot season whereas LTL for supplier B was higher in hot season than cold season. In contrast, pork produced from supplier C showed much lower cook loss in hot season than cold season regardless of muscles ($P < 0.001$). The drip loss results tended to be the inverse of the cook loss; TB generally had the lowest drip loss, but the highest cook loss and LTL had highest drip loss and lowest cook loss.

Table 2 – Effect of season (cold, hot) and muscle (LTL, BF, TB) on meat quality for the three suppliers (A, B, C).

	LTL		BF		TB			*P* value		
	Cold	Hot	Cold	Hot	Cold	Hot	SED	Season	Muscle	Season x Muscle
pHu										
A	5.40	5.53	5.49	5.58	5.60	5.85	0.025	**< 0.001**	**< 0.001**	**< 0.001**
B	5.43	5.42	5.53	5.55	5.67	5.64	0.018	0.640	**< 0.001**	0.271
C	5.28	5.66	5.38	5.75	5.64	5.79	0.039	**< 0.001**	**< 0.001**	**< 0.001**
Drip loss										
A	3.13	2.99	2.49	3.04	0.48	0.82	0.265	0.179	**< 0.001**	0.132
B	5.43	4.18	3.24	4.09	0.58	1.05	0.369	0.829	**< 0.001**	**< 0.001**
C	4.36	3.75	3.17	3.21	0.43	1.03	0.310	0.798	**< 0.001**	**0.008**
Cook loss										
A	21.52	20.60	22.46	22.68	22.62	24.21	0.558	0.505	**< 0.001**	**0.002**
B	21.35	23.84	25.37	25.18	25.20	25.23	0.499	**0.034**	**< 0.001**	**< 0.001**
C	22.22	16.76	23.70	17.98	24.29	20.08	0.479	**< 0.001**	**< 0.001**	**0.038**
L*										
A	45.51	48.23	38.76	42.90	38.31	38.81	0.633	**< 0.001**	**< 0.001**	**< 0.001**
B	46.25	46.09	40.99	41.03	40.04	39.64	0.559	0.681	**< 0.001**	0.815
C	45.24	46.11	40.94	41.89	38.32	38.72	0.501	**0.012**	**< 0.001**	0.623
a*										
A	4.13	5.15	10.03	10.70	11.48	11.62	0.336	**0.023**	**< 0.001**	0.135
B	4.29	5.07	9.87	9.96	11.46	12.30	0.324	**0.038**	**< 0.001**	0.105
C	5.48	6.05	10.20	11.73	12.04	13.29	0.409	**< 0.001**	**< 0.001**	0.205

IV. CONCLUSION

Pigs slaughtered in the hot season generally produced pork with higher redness across all muscles, higher lightness and higher pH for suppliers A and C, and decreased cook loss for supplier C, compared to the cold season. In addition, TB had the lowest drip loss but highest cook loss. Overall, season and supplier were found to influence variation in pork quality and the effect varied between muscles.

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