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Effects of Breed Type, Residual Feed Intake and Post-Mortem Aging on Physio-Chemical Properties of *Triceps Brachii* Muscle and Their Relationships With Beef Toughness

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Objectives

The influence of breed type, residual feed intake (RFI) and post-mortem aging on meat and carcass quality attributes and intramuscular connective tissue characteristics were examined in the bovine *Triceps brachii*, a high connective tissue muscle from the chuck. The hypothesis that selection for low RFI in beef cattle increases beef toughness, increases collagen content and reduces collagen heat solubility of the *Triceps brachii* was tested.

Materials and Methods

Seventy-one beef steers from Angus (n = 23), Charolais (n = 24) and Angus crossbred (n = 24)) genetics were used. Each breed had high RFI and low RFI steers (n = 12). Muscles collected were aged for 3- and 13-days post-mortem (dpm). Final animal live weight, grade marbling, intramuscular pH, water holding capacity (WHC), intramuscular fat, cooking loss, drip loss, protein, temperature, moisture, color, RFI, and Warner Bratzler shear force (WBSF) data were collected for carcass and meat quality measurements.

Table 7. Least square means (± standard error of the mean) for WBSF, soluble collagen, and collagen solubility of *Triceps brachii* muscles at 3 and 13 d post-mortem aging (dpm)

Measurements (unit)	Aging periods		P value
	3 dpm (n = 71)	13 dpm (n =71)	
WBSF (kg)	3.7 ± 0.08[a]	3.2 ± 0.08[b]	<0.0001
Soluble collagen (mg/g raw meat)	1.3 ± 0.18[b]	1.8 ± 0.18[a]	0.0002
Collagen heat solubility (%)	18.0 ± 4.2[b]	25.9 ± 4.2[a]	0.0002

a, b Least Square Means within a row lacking a common letter differ at P ≤ 0.05

Total collagen, collagen heat solubility, and collagen cross-link Ehrlich's chromogen (EC) of the isolated perimysium were quantified. Data were analyzed using a split-plot experimental design procedure (R software 3.4.1) with breed and RFI as main effects in the whole plot and postmortem aging included at the subplot level.

Results

Final weight was significantly greater for Charolais (683 ± 9.58 kg) than Angus (554 ± 9.65 kg) and Angus crossbred (568 kg ± 9.58 kg) steers (P = 0.017), and grade marbling score was higher for high RFI (421 ± 19.85) than for low RFI steer carcasses (385 ± 19.82) (P = 0.001). No significant effects of breed type and RFI (P > 0.05) were observed on meat quality attributes. WBSF value at 3 dpm (3.72 kg) was significantly higher than at 13dpm (3.21 kg) (P < 0.005). Collagen solubility was significantly higher at 13 dpm (25.88%) than at 3 dpm (18.03%) (P < 0.005). Total collagen and wet endomysium were positively correlated (r = 0.44) as were total collagen and EC in raw muscle (r = 0.76), EC and wet perimysium (r = 0.42) and WBSF and EC at 13 dpm (r = 0.27) (P < 0.005). Total collagen and collagen solubility at 3dpm (r = –0.36) and 13 dpm (r = –0.63) were negatively correlated, as were EC and solubility at 3 dpm (r = –0.38) (P < 0.005).

Conclusion

Increasing postmortem aging periods reduced WBSF and increased collagen heat solubility of the Triceps brachii muscle. With no effect of RFI on meat quality measurements, the production cost can be reduced by selecting for low RFI animals without sacrificing product quality.