The effect of two years frozen storage at -18°C or -12°C on aged beef quality traits

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Frozen storage preserves beef safety and quality attributes. The subzero temperature requirements for frozen storage will depend on the end-market *viz*. the European Union requires beef to be held at -12°C whereas Australian beef is conventionally held at -18°C. Extended frozen storage may provide logistical benefits and broaden export market access. The impact of different temperatures on frozen storage periods of up to 2 years has not been considered for Australian beef. This study aimed to fulfil this paucity.

Beef *longissimus lumborum* muscles (striploin) were randomly selected (Holman *et al*. 2017), portioned, vacuum-packaged and aged for five weeks. Samples assigned to no frozen storage (Not Frozen, total: 8) were analysed immediately. Samples assigned to frozen storage (Frozen) were equally held at either -12°C and -18°C temperatures within replicated freezers (total: 8). Samples were analysed for eating quality (shear force, sarcomere length, particle size, ultimate pH, glycogen), moisture traits (total moisture, cook loss, thaw loss) and colorimetrics measured over three days of retail display. Data were analysed using linear mixed models (*Genstat v19*) fitted with storage and temperature as fixed terms; and striploin as a random term when appropriate. Colorimetric data were analysed with storage, temperature, display period and their interactions as fixed terms; and striploin as a random term.

Table 1. The predicted mean, standard error (sem) and level of significance for the effect of frozen storage and temperature on beef *longissimus lumborum* muscle quality traits.

Trait	Not frozen	Frozen 2 years	sem	P-values	
				Storage	Temperature
Shear force, N	27.5	30.5	2.86	0.120	0.612
Sarcomere length, µm	1.97	1.83	0.08	0.159	0.442
Particle size, µm	93.9	181.7	19.17	<0.001	0.392
Ultimate pH, U	5.71	5.54	0.02	<0.001	0.517
Glycogen content, mmol/kg	48.5	61.9	8.59	0.312	0.255
Total Moisture, %	55.2	52.3	1.43	0.011	0.253
Cook loss, %	22.0	14.2	1.09	<0.001	0.510
Thaw loss, %	.	3.4	0.62	.	0.391

Table 1 shows that frozen storage temperature did not impact on beef, in terms of the assessed metrics, either as an independent term or within an interaction. This suggests that -12°C can deliver the same eating quality, moisture traits and colour stability as -18°C, an outcome that could reduce the energy requirements of frozen Australian beef. Frozen storage itself (2 years) impacted on beef ultimate pH, particle size, cook loss and total moisture content. When thawed and placed under display, beef colorimetrics (a*, b*, hue, chroma, R630/580) were different to their not frozen counterparts. These reaffirm the quality penalties associated with frozen-thawed beef.

References

Holman BWB, Coombs CEO, Morris S, Kerr MJ, and Hopkins DL (2017) *Meat Science*. **133** 133-142.

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