THE VALUE OF PRECISE DEXA CUT WEIGHT PREDICTIONS IN OPTIMISED LAMB PROCESSING

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I. INTRODUCTION

The introduction of dual energy X-ray absorptiometry (DEXA) scanners into Australian lamb abattoirs has improved objective measurement of lamb carcase yield, an important profit driver along the supply chain. By improving the precision and accuracy of carcase yield prediction from prior standards using GR tissue depth (GR) [1], DEXA can also improve the precision and accuracy of commercial cut weight predictions [2]. For processors, improved cut weight prediction provides an opportunity to optimise the sorting and processing of carcases to ensure that cut specifications of high value markets are met and profits are optimised. However, the value that more precise and accurate DEXA cut weight predictions represents to processors has not been shown. This study investigates this using the Lamb Carcase Optimiser Tool (LCOT); a tool developed for processors to determine the most profitable allocation of lamb carcases to fabrication cut specifications. We hypothesise that more precise DEXA cut weight predictions will provide an optimised solution closer to that achieved using actual lamb cut weights.

II. MATERIALS AND METHODS

Genetically diverse lamb carcases (n = 191) were measured for GR (mm), hot standard carcase weight (HSCW, kg) and DEXA scanned on-line. Lamb carcases were boned out by 4 boners according to a detailed protocol and commercial cuts, and bone, lean and fat trim were weighed. DEXA images were analysed [2] to produce carcase DEXA values representing carcase lean and other image components such as carcase pixel number and mean -log (pixel value) for the low energy image. Data was analysed by transforming cut and carcase weight values into natural logarithms [3] after which General Linear Mixed models (in SAS) were used to predict the loge cut weight from loge HSCW, loge HSCW plus GR, or loge HSCW plus a selection of DEXA image values. These cut weight predictions were previously described in detail [2]. By sampling from a multivariate normal distribution this smaller dataset was then used as the basis to simulate a larger data set of 10,000 lambs with matching mean, standard deviation, and covariance relationships between all terms. This larger dataset was then truncated to 4,500 lambs that reflected a typical HSCW distribution for one day at a local abattoir. Data was input into the LCOT to optimise the allocation of carcases into 3 cut options using different cut weight inputs (actual vs predicted).

III. RESULTS AND DISCUSSION

The number of cut option misallocations made using different cut weight predictors are shown in Table 2 and align with our hypothesis - with DEXA predictions resulting in 105 or 8.05% less cut misallocations than GR. These misallocations were caused by cut weight predictions that exceeded or failed to meet a cut weight threshold defined in the scenario (Table 1), preventing their allocation to the most profitable option determined using actual cut weights. In fact, most lamb abattoirs use only HSCW to sort carcases into boning runs, therefore DEXA provides the opportunity to reduce cut misallocations by 16.7% compared to current practise. While GR produced slightly less cut misallocations than DEXA in the forequarter, these misallocations related to errors in boneless shoulder weight predictions, a cut that GR actually predicts with slightly higher precision than DEXA. Using DEXA cut weight predictors had the most impact in sorting carcases into loin and hindquarter cut plans, where DEXA reduced cut misallocations by 21 and 25% compared to using HSCW alone.

Table 1 Cut options available to process the lamb carcases^, including cut specification (spec), cut weight thresholds and the wholesale value in $AUD of each cut.

	Option 1			Option 2			Option 3		
	Cut spec, threshold (kg) & value ($/kg)			Cut spec, threshold (kg) & value ($/kg)			Cut spec, threshold (kg) & value ($/kg)		
HQ	Leg chump on Hind shank tipped	≤2.75	9.6 8.4	Chump bone out Butt tenderloin Round Rump Silverside Topside	≥ 0.55	16.8 29.4 15.6 16.8 13.2 15.6	Leg chump off Chump bone out	Nil	9.0 16.8
Loin	Shortloin eye Tenderloin	0.55-1.5	25.2 29.4	Shortloin no tail, 6mm fat	≥ 0.6	16.2	Shortloin, 50mm tail, 10mm fat	≤ 1.55	15.6
Rack	French rack	≥0.65	27.6	Rack 6mm fat	≤ 1.4	9.6			
FQ	Square cut shoulder	Nil	8.4	Best end shoulder chop	1- 2.2	6.0	Boneless shoulder	≥ 2.0	12.0

^Different sections (Hind or HQ, loin, rack and fore or FQ) of the same carcase can be allocated to different cut options.

Table 2. Cut misallocations made by the Lamb Carcase Optimisation Tool using cut weight predictions informed by HSCW, HSCW & GR or HSCW & DEXA values. Misallocations are shown in each carcase section and reflect allocations differing from optimised allocation using actual cut weights.

Carcase section	HSCW	HSCW & GR	HSCW & DEXA
Forequarter	291	255	260
Rack	356	348	333
Shortloin	332	307	263
Hindquarter	462	395	344
Total	1441	1305	1200
Total % errors	8.01	7.25	6.67

IV. CONCLUSION

On-line lamb DEXA predictions of carcase cut weights can reduce cut misallocations by up to 17%, reducing the need for processors to retrim and repackage product and the erosion of customer confidence caused by supplying product that does not meet market specifications. DEXA thus provides the opportunity for processors to better forecast their inventory, to reduce costs associated with cut misallocations and to build market confidence in their product.

REFERENCES

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