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Killorder and not plasma lactate concentration is related to tenderness in lamb

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Previous research indicates that acute stress prior to slaughter is linked with a reduction in meat quality in beef but few studies have examined this association in lamb using plasma indicators. Warner *et al.,* (2007) demonstrated that exposure to acute stress simulated with electric prodders resulted in an increase in plasma lactate in cattle as well as decreased tenderness scores in beef assessed by consumers. Tenderness is a strong driver of consumer acceptability and can be measured objectively by Warner Bratzler Shear Force (WBSF). Thus we hypothesise that increasing plasma lactate concentrations at slaughter will be associated with increased M. *longissimus lumborum* (loin) WBSF values in lamb.

Blood was collected at exsanguination following electrical head stunning from 1,436 lambs from two sites of the Meat and Livestock Australia genetic resource flocks; Katanning (WA) and Armidale (NSW). Prior to slaughter, lambs were subjected to 4 hours of feed curfew on farm and then transported to commercial abattoirs (0.5-2 hours) where they were held in lairage overnight and slaughtered the following morning. Plasma was prepared and analysed for lactate concentration. Carcasses (mean carcass weight 23.5±2.7 kg) were subjected to medium voltage electrical stimulation before being chilled overnight at 3-4ºC. Loin samples were removed from the carcass, vacuum packed and frozen at −20 °C after 5 days aging at 1ºC. Frozen samples were cooked to an internal temperature of 71°C and then cooled in running water for 30 minutes. Shear force was measured on replicate samples using a Lloyd texture analyser with a Warner–Bratzler shear blade fitted. The WBSF and plasma lactate data was analysed using linear mixed effects models with fixed effects for site, sex and dam breed within sire type, kill group within site, birth type and rear type. Kill order or lactate was included as covariates with sire and dam identification included as random terms. The model was corrected for ultimate pH and it had no impact on the significance of fixed and covariate terms.

Figure. Relationship between loin WBSF (N) and kill order. Line represent lsmeans ± s.e. ● denotes residuals from response line.

There was no significant association between plasma lactate and WBSF ($P>0.05$). Increasing killorder from 0 to 300 lead to a 19% increase in WBSF from 32.3 to 38.7N ($P<0.05$, figure).

Contrary to the hypothesis, WBSF values were not associated with plasma lactate concentration at slaughter; however increasing kill order was related to an increase in WBSF. Kill order describes the duration of exposure to immediate pre-slaughter processes including lead up to the stunning restrainer. Thus it more accurately reflects the acute stress response at slaughter, in contrast to plasma lactate concentration which also reflects other factors such as muscle contraction. The WBSF values found in this study were higher than 27 N, which is associated with a 10% failure rate for lamb eating quality (Hopkins *et al.,* 2006). Further work is required to understand the immediate pre-slaughter factors, reflected by kill order in this study, that are impacting on tenderness in order to improve consumer acceptability of Australian lamb.

Hopkins, D.L. *et al.* (2006). *Australian Journal of Experimental Agriculture* **46**: 879-884.
Warner, R. *et al*. (2007) *Animal Production Science* **47**: 782-78.