Associations Between Plasma Lactate at Slaughter and Ultimate pH in Lamb

S.M. Stewart, P. McGilchrist, G.E. Gardner and D.W. Pethick

School of Veterinary and Life Sciences, Murdoch University, South Street, 6150 Murdoch, W.A. Australia

There are numerous studies in beef and lamb indicating that a link exists between stress and meat quality but few have examined this association using indicators of stress in plasma. The pre-slaughter period has increased levels of handling, physical activity and changes to social structure which can result in elevated circulating adrenaline levels, increasing muscle glycogenolysis, leading to elevated plasma lactate concentrations (Martin et al 2011). Depletion of muscle glycogen can result in an increase in ultimate pH, which negatively affects eating quality attributes. Thus we hypothesise that increasing plasma lactate concentrations at slaughter will be associated with an increased ultimate pH at 24 hours post-slaughter (pH24LL).

Blood was collected from 1531 lambs from two sites of the Meat and Livestock Australia genetic resource flocks; Katanning (WA) and Armidale (NSW). Lambs underwent routine pre-slaughter management and were placed in curfew for approximately 2 hours on-farm before transport to commercial abattoirs for 0.25hrs and 2 hours duration respectively. Lambs remained in lairage overnight (17.9 ± 1.79 hours) and were slaughtered the following morning. Following exsanguination, blood was centrifuged and heparinised plasma was analysed for lactate concentration. Carcasses (mean hot standard carcass weight of 23.5±2.7 kg and mean GR site depth (mm) of 14.6±5.2) were subjected to medium voltage electrical stimulation before being chilled overnight at 3-4°C. pH measures were taken at 24 hours post mortem in the M. *longissimus lumborum* (pH24LL). The pH24LL/lactate data was analysed using linear mixed effects models with fixed effects for site, sex and dambreed within siretype, killgroup within flock, killorder, killorder within flock, reartype, lactate, lactate within flock and lactate within reartype. Sire and dam identification were included as random terms.

Site had a significant effect on pH24LL ($P < 0.05$). The WA pH24LLwas 5.72 ± 0.014 and NSW was 5.64 ±0.014. Plasma lactate concentration had a significant effect on pH24LLat both sites ($P < 0.05$). As plasma lactate increased from 1mmol/L to 14mmol/L, pH24LL decreased from 5.75 to 5.60 at the WA site and increased from 5.64 to 5.66 at the NSW site ($P < 0.05$).

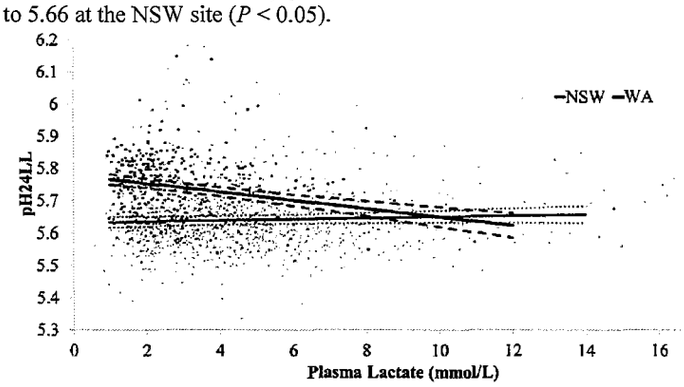

Figure 1: Relationship between plasma lactate at slaughter (mmol/L) and pH24LL. Lines represent ls means ± s.e. ■ denotes WA lamb residuals and × denotes NSW lamb residuals.

Contrary to the hypothesis, increased plasma lactate concentrations were associated with a decrease in pH24LL at the WA site.The mechanistic reason for this is unclear, however previous studies in lamb have shown that higher initial glycogen levels have faster rates of muscle glycogenolysis (Daly et al 2006). Alternatively, pH24LL may not be at ultimate pH, which could reflect site differences in carcass electrical stimulation and chilling rate, thus higher lactate indicates more rapid glycolysis resulting in a lower pH24LL. Although a significant increase was seen at the NSW site, the increase was numerically small with little effect on final meat quality. This result in NSW may be due to higher muscle glycogen levels and a protective buffer against pre-slaughter stress. Opportunities exist to reduce variation in meat quality and plasma indicators of stress may facilitate development of best practice slaughter pathways in order to maximise eating quality and animal welfare.

Daly, B.L., Gardner, G.E., Ferguson, D.M. and J.M. Thompson. (2006). *Aust. J. Agric. Res.* **57**, 1229.
Martin K.M. McGilchrist, P. Thompson, J.M. and G.E. Gardner. (2011). *Animal* **5**, 1060.

This work was funded by AMPC

Email: S.Stewart@murdoch.edu.au