# Recent Research Evaluating Stress in Transported Lambs

*Examines three studies that may aid in improving mechanisms for measuring and/or preventing stress in lambs during transportation.*

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## Introduction

Transportation can inflict multiple stressors on lambs that compromise their welfare. Stress, defined by Moberg & Mench (2000) as "the biological response elicited when an individual perceives a threat to its homeostasis", can have harmful effects on animals (Moberg & Mench, 2000) and can be triggered by environmental conditions or stimuli. Stressors, include food and water deprivation during transport, heat stress, novel environments and high stocking densities (Fisher *et al*., 2009; Teke *et al*., 2014). Recent studies have particularly analysed the effects of transport on biochemical stress indicators in lambs (Teke *et al*., 2014; Hall *et al*., 2014), as well as methods that could potentially alleviate stress in order to improve the welfare of lambs in transit (Pye *et al*., 2015).

## Discussion

In Australia, the minimum floor area required for lambs weighing 30kg is 0.19$m^2$ per head (Animal Health Australia, 2008). A study by Teke *et al.* (2014) compared biochemical stress indicators in two groups of lambs (29.0±1.4kg live weight) transported at a stocking density of either 0.20$m^2$/lamb (n=33), or 0.27$m^2$/lamb (n=22). Blood samples from the lambs before and immediately after transportation were analysed for plasma concentrations of glucose, lactate, cortisol, creatine kinase (CK), lactate dehydrogenase and alanine aminotransferase (ALT), all typical biochemical stress indicators for sheep (Tadich *et al*., 2009; Miranda-de la lama *et al*., 2011). It was found that lambs stocked at higher densities during transit had significantly higher concentrations of all these indicators after transportation compared to lambs stocked at lower densities. As with a previous study (Ibanez *et al*., 2002), it was concluded that higher stocking densities during transportation of lambs caused a significant increase in biochemical stress indicators (Teke *et al.,* 2014).

Concentrations of certain blood constituents, other than those examined by Teke *et al.* (2014), can also be used to assess stress in sheep. Hall *et al.* (2014) hypothesised that transportation would promote a stress response in lambs that would ultimately result in decreased concentrations of glutathione (GSH) and selenium. The basis for this hypothesis is that stress in sheep can cause an increased release of reactive oxygen species (Piccione *et al*., 2013) that require enzymes containing GSH and selenium for their elimination (Rotruck *et al*., 1973). The experimental lambs (n=20) were transported for eight hours and then deprived of feed for a further 16 hours. Blood results showed a significant increase in serum selenium concentrations 16 hours after transportation, which did not align with the hypothesis. At 64 hours post-transport, this serum selenium increase was no longer significant. Hall *et al.* (2014) suggested that these results may be due to selenium mobilisation during stress. GSH concentrations decreased significantly more in the experimental group than in the control group – suggesting higher levels of stress in the transported group (Hall *et al.*, 2014). Although further research is required to understand more about GSH and selenium concentrations in stressed sheep, Hall *et al.* (2014) showed that the concentrations of GSH and selenium in the blood are influenced by stressors, such as transport. Thus, in addition to the typical biochemical stress indicators analysed by Teke *et al.* (2014), GSH and selenium concentrations have potential for improving our understanding of stress in transported sheep.

Recent studies have also investigated modifications in nutrition to reduce stress in transported lambs (Pye *et al*., 2015). These researchers aimed to determine whether supplementation of dietary magnesium in lambs would reduce transport-associated stress. Previous research in 1996 by Terashima and Taki (cited in Pye *et al*., 2015) has shown that magnesium can reduce concentrations of cortisol and catecholamines in hypothermic sheep. [Similar results were also seen in transported pigs in a 1985 study by Kietzmann and Jablonski (cited in Pye *et al*., 2015).]

In Pye *et al.*'s 2015 study, four-month-old prime lambs (n=18) were supplemented for two weeks prior to transportation with magnesium oxide (0.41% of diet), while control lambs (n=18) were fed the same diet but without the magnesium supplementation (0.17% of diet). The lambs were then transported by trailer for eight hours – three hours of which were stationary. It was found that the average daily feed intake and weight gain was significantly lower in lambs after transportation compared to before (Pye *et al*., 2015). This has implications for both welfare and economic consequences. However, blood analysis showed that despite the magnesium-supplemented group having significantly higher concentrations of serum magnesium prior to transport, there was no significant reduction in cortisol concentrations after transportation when compared to the control group.

Pye *et al.* (2015) speculate that the levels of magnesium supplementation "may not have been high enough to confer stress resistance". Interestingly, though, the levels of magnesium, at 0.41% DMI, fed to the experimental group were beyond the recommended concentrations for growing lambs (0.12% DMI) (Subcommittee on Sheep Nutrition *et al*., 1985). Pye *et al.* (2015) also suggested that the use of dietary magnesium in merino lambs, rather than the second-cross lambs that were used in the experiment, could be effective in reducing serum cortisol concentrations after transport. This is because merinos show a greater stress response than other sheep breeds (Gardner *et al*., 1999). Additionally, the stocking density throughout Pye *et al.*'s experiment was relatively low ($2m^2$/lamb) compared to those stocking densities tested by Teke *et al.* (2014) ($0.20m^2$/lamb and $0.27m^2$/lamb), so perhaps imposing more stressors on lambs by increasing stocking densities would result in greater cortisol release and, potentially, a clearer effect of magnesium supplementation on stress. Like the studies by Teke *et al.* (2014) and Hall *et al.* (2014), Pye *et al.* (2015) assessed a relatively small sample size, and larger sample sizes would improve the reliability of results.

## Conclusion

In combination, these studies provide an insight into scientific developments that can be used to both evaluate and improve the welfare of sheep and lambs in transit. Ultimately, transport may always impose some stress upon production animals, but as scientific developments continue, hopefully we will be able to minimise stress to improve both the welfare of sheep and their economic potential after transport.

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