



LambEx 2012 Conference Proceedings

Document ID:	SheepCRC_33_12
Title:	Selection for leanness decreases meat aerobicity
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Key words:	Sheep; ASBVs; PFAT;

This paper was presented at the LambEx Conference held in 2012, as part of the Sheep CRC presentations. The paper should be cited as:

K.R. Kelman, L. Pannier, D.W. Pethick, G.E. Gardner (2012) – *Selection for leanness decreases meat aerobicity*

Selection for leanness decreases meat aerobicity

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The Australian lamb industry uses Australian Sheep Breeding Values for reduced post-weaning subcutaneous fat depth (PFAT) to select for leanness and increased lean meat yield. Selection for reduced PFAT results in increased loin muscle weight (Gardner *et al* 2010) potentially leading to lower oxidative capacity in muscle (Greenwood *et al* 2006). Isocitrate dehydrogenase activity (ICDH) is an accepted indicator of aerobic metabolism, and therefore we hypothesise that selection for reduced PFAT results in a decrease in ICDH levels.

ICDH, intramuscular fat percentage (IMF), short loin muscle weight and short loin fat weight were measured in 1397 lambs from the 2007 and 2008 drop within seven sites of the Information Nucleus Flock of the Sheep Cooperative Research Centre. ICDH was analysed using a linear mixed effects model with fixed effects for site, kill group within site, sex, birth type-rear type, age of dam, sire type and dam breed within sire type, and random terms for sire and dam. Within this model, PFAT, IMF and the weights of short loin fat and muscle were individually included as covariates to assess their phenotypic association with ICDH.

Selection for reduced PFAT decreased ICDH by 0.46 $\mu\text{mol}/\text{min}/\text{g}$ tissue across the PFAT range (Figure 1). However, neither short loin muscle nor fat weight demonstrated any association with ICDH. Alternatively, ICDH was strongly associated with IMF, with a 4% decrease in IMF aligning with a 0.88 $\mu\text{mol}/\text{min}/\text{g}$ tissue reduction in ICDH (Figure 2). When PFAT and IMF were included concurrently within the ICDH model, there was no change in the PFAT effect and a small increase in the IMF effect to 0.99 $\mu\text{mol}/\text{min}/\text{g}$ tissue.

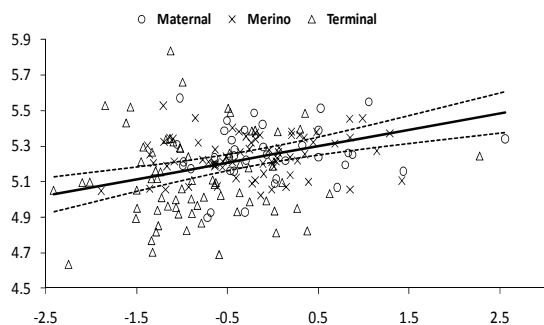


Figure 1 Relationship between ICDH and PFAT. Lines represent *lsmeans* \pm *s.e.* and icons represent sire means.

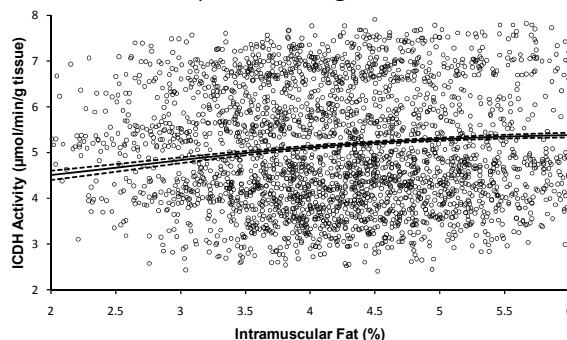


Figure 2 Relationship between ICDH and IMF percentage. Lines represent *lsmeans* \pm *s.e.*

In line with the hypothesis, selection for reduced PFAT decreased ICDH. As producers select for a reduction in PFAT to improve lean meat yield the impacts of this selection need to be carefully managed. This is because PFAT has also been shown to reduce IMF (Gardner *et al* 2010) and this reduction in IMF is also associated with a reduction in ICDH and therefore aerobicity. As ICDH levels fall, so does myoglobin which is a concern because it results in whiter meat that is lower in the nutrients iron and zinc, which are important consumer traits. Alternatively, whiter meat also has better retail colour stability, increasing the shelf life of the final product but not the consumer appeal given its whiter colour. Therefore any attempt to select for reduced PFAT or increased IMF should be combined with careful monitoring of muscle aerobicity and its associated impacts on meat colour, nutrient content and retail colour stability.

Gardner, G. E., A. Williams, et al. (2010) *Animal Production Science* **50**(12): 1098-1106.

Greenwood, P. L., G. E. Gardner, et al. (2006) *Australian Journal of Agricultural Research* **57**(6): 627-639.