DEHYDRATION DOES NOT CHANGE THE EATING QUALITY OF LAMB MEAT

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Introduction

A recent study suggested that the prevalence of subclinical dehydration in lambs at the time of slaughter in Australian abattoirs could be high (Jacob *et al.*, 2006). This was attributed to lambs failing to drink water in lairage rather than to extreme climatic conditions. Whilst dehydration can reduce carcass weight, meat yield and be an indicator of compromised animal welfare during the pre-slaughter period, little is known about the potential for dehydration to reduce the eating quality of lamb meat. Eating quality dominates the decision by consumers to repurchase meat so is an important part of the strategy to build demand for Australian lamb meat products worldwide (Russell *et al.*, 2005).

A study by Warner *et al.* (2002) suggested that water deprivation may actually improve tenderness but did not examine other sensory factors. Jacob *et al.* (2006) found urine specific gravity (USG) to be a simple indicator of water deprivation suitable for use in a commercial scenario. The upper physiological limit for USG in sheep is 1.045 (Kaneko *et al.*, 1997) above which tissue hydration can be reduced (Jacob *et al.*, 2006). In this study we used USG to identify lambs of different hydration status for the purpose of conducting consumer taste panel evaluations of the eating quality of lamb meat.

Materials and Methods

First cross merino lambs were selected from 9 different vendor consignments, and slaughtered under commercial conditions at an abattoir in Western Australia. The lambs were slaughtered by electrical head stunning followed by exsanguination. Urine was collected from the bladder of all castrated male lambs in each consignment soon after slaughter and USG measured immediately using a Reichert veterinary refractometer (Model 10436, Cambridge Instruments Inc., Buffalo, USA). From each consignment 6 lambs were then selected consisting of 3 lambs with a low USG (USG<1.030) and 3 lambs with a high USG (USG>1.045). This procedure was done over 2 days with 4 consignments being sampled on October 18 2005 and 5 consignments on October 25 2005. The lamb carcasses were electrically stimulated using a post dressing medium voltage stimulation unit with settings of 2.5ms pulse duration, 1A current, and 15Hz frequency.

One backstrap *(m. longisimuss thoracis et lumborum)* and 2 silversides (*m. biceps femoris)* were dissected from each carcass 48 hours post slaughter then aged for 6 days at a temperature of 2°C. Ultimate pH (pHu) was measured in both muscles 48 hours after slaughter. Samples of loin BKS045 (Anonymous 1998) and silverside OUT005 (Anonymous 1998) were then prepared and frozen in readiness for consumer panel evaluation.

Consumer panel sensory evaluation was conducted at a centralised location in Sydney, using untrained consumer panels. Consumers were asked to score steaks for tenderness, liking of flavour, liking of smell, juiciness and overall liking from 0-100 and also to rate the meat as either unsatisfactory, good every day or better than every day. The panels were conducted according to the method outlined in Thompson *et al.* (2005) whereby 1.5cm thick chops were grilled to a medium degree of doneness (71°C internal temperature) following thawing. They were then halved and presented to consumers giving a total of 10 consumer responses for each experimental muscle making a total of 1080 steaks tested this way. Panel members were allocated across treatments such that each consumer tasted 3 samples from high USG lambs and 3 samples from low USG lambs. Samples were allocated to a testing layout using a Latin square design and the 10 portions of each cut were served in a different order to avoid bias due to order of tasting.

Eating quality data were analysed using analysis of variance (ANOVA) for the effects of USG class (low and high) for each cut of meat (loin BKS045 and silverside OUT005). Data was blocked for the fixed effects of consignment within each sample date. Carcass data was also analysed using ANOVA with tissue depth (GR) being adjusted using carcass weight as a covariate. These analyses were performed using Genstat 7.0. (VSN International Ltd, www.vsn-intl.com). Eating quality data was "clipped" prior to analyses to reduce consumer variation. This involved removing the highest and lowest values in each group of 10 scores.

Results and Discussion

A significant difference ($P<0.01$) occurred between the GR tissue depth in the low and high USG categories (Table 1). This may have been due to a selection bias caused by smaller numbers of low USG lambs being available than high USG lambs rather than an effect of USG category on tissue depth. In all consignments the majority of lambs had a high USG.

There was no effect ($P>0.05$) of USG category on the eating quality of loin or silverside for overall liking, liking of flavour, juiciness, liking of smell, and tenderness (Table 2). However, the percentage of consumers rating the loin

unsatisfactory was higher for low USG compared to high USG lambs. Although significant, the GR tissue depth difference between groups was small and may not have accounted for this difference in failure rate.

Table 1: Carcass and urine specific gravity data.

Carcass measurement	Low USG	High USG	5% LSD	Significance
GR tissue depth(mm)	13.9	15.6	1.31	**
Carcass weight adjusted for shrinkage (kg)	22.8	23.4	0.83	NS
pHu *m. longisimuss thoracis et lumborum*	5.59	5.62	0.04	NS
pHu *m. biceps femoris*	5.63	5.64	0.03	NS
USG	1.009	1.055	0.0013	**

* P<0.05, ** P < 0.001, NS not significant P>0.05, 5% LSD least significant difference at the 5% level

Table 2: Consumer panel data.

Attribute	Low USG	High USG	5% LSD	Significance
Loin (BKS045)				
Overall liking	66.7	69.6	4.94	NS
Liking of flavour	65.6	68.5	4.65	NS
Juiciness	62.2	63.9	6.15	NS
Liking of smell	67.7	68.9	3.71	NS
Tenderness	72.5	72.7	5.62	NS
% Unsatisfactory	9.9	1.9	7.08	*
Silverside (OUT005)				
Overall liking	64.4	66.3	4.83	NS
Liking of flavour	64.0	65.8	4.82	NS
Juiciness	66.1	65.7	4.32	NS
Liking of smell	67.4	71.0	3.61	NS
Tenderness	62.1	64.0	5.58	NS
% Unsatisfactory	6.2	6.8	6.08	NS

* P<0.05, ** P < 0.001, NS not significant P>0.05, 5% LSD least significant difference at the 5% level

Conclusions

Dehydration of lambs within the range found under commercial Australian conditions does not change the eating quality of lamb meat.

References

Anonymous (1998). Handbook of Australian Meat. (Ausmeat: Brisbane).

Jacob, R., Pethick, D., Clark, P., D'Souza, D., Hopkins, D. and White, J. (2006). Quantifying the hydration status of lambs in relation to carcass characteristics. *Australian Journal of Experimental Agriculture*, 46, 1-9.

Jacob, R., Pethick, D. W., Ponnampalam, E., Speijers, J. and Hopkins, D. (2006). The hydration status of lambs after lairage at 2 Australian abattoirs. *Proceedings of the Australian Society of Animal Production*. Accepted for publication.

Kaneko, J., Harvey J. and Bruss, M. (1997). Clinical biochemistry of domestic animals.' (Academic Press: San Diego, California).

Russell, B., McAlister, G., Ross, I. and Pethick, D. (2005). Lamb and sheep meat eating quality- industry and scientific issues and the need for integrated research. *Australian Journal of Experimental Agriculture*, 45, 465-467.

Thompson, J., Gee, A., Hopkins, D., Pethick, D., Baud, S. and O'Halloran, W. (2005). Development of a sensory protocol for testing palatability of sheep meats. *Australian Journal of Experimental Agriculture*, 45, 469-476.

Warner, R., Cotrell, J., D'Souza, D., Kerr, M., Bond, J. (2002). The effect of time off water pre-slaughter on lamb meat quality. In: Proceedings of the 48th International Congress of Meat Science and Technology. Rome. (Eds R Chizzolini) pp. 368-69.