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Impacts Of Heat Stress On Retail Meat Quality Of 2ND Cross And Dorper Lambs (#620)

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Introduction

High environmental temperatures compromise animal welfare and productivity during hot summer months. Heat stress (HS) has become one of the major challenges for the livestock and meat industry. Heat stress not only imposes negative effects on animal physiology and growth performance, but has also been reported to cause a higher incidence of dark firm and dry (DFD) or pale soft and exudative (PSE) meat [1]. However, previous research of the effect of heat stress on animal growth performance and meat quality is very limited, and results are equivocal which could be because of different species, breeds, and the duration of heat exposure. For example, Kadim et al. [2] suggested that acute and chronic heat stress had negative effect on fresh colour, shear force and water holding capacity (WHC) of sheep meat. Conversely, Hashem et al. [3] reported that 4- 8 hours heat exposure in summer had no significant effect on goat slaughter weight and drip loss of the meat. Therefore, a systematic heat stress experiment is needed to examine HS impacts on meat quality under commercial conditions. This experiment was designed to measure the impact of heat stress on meat quality of 2nd cross (Poll Dorset X (Merino X Border Leicester)) and Dorper lambs, which may have better heat tolerance [4], finished under 2 weeks of HS in climate chambers.

Methods

This experiment was approved by FVAS Animal Ethics Committee (AEC ID 1714357.1). 48 lambs (4-5 months old, 38 – 42 kg liveweight; 24 of each breed) were obtained. Lambs were acclimatized for 2 weeks in group pens and then housed in individual pens for the experiment. Lambs were fed a diet of oaten (25%) and lucerne (25%) chaff, and standard finisher pellets (50%) *ad libitum and* water was available *ad libitum*. After acclimatization, animals were exposed to thermo-neutral (TN; 18-21°C, 40-50% RH, n=12) or cyclic HS (28°C- 40°C, 40-60% RH, n=12) for 2 weeks in climate chambers. All slaughter procedures were followed as per standard commercial operations including stunning and electrical stimulation. *Longissimus lumborum*(LL) muscle was removed at 24 h postmortem, sliced into 2.5 cm steaks, and packaged using HiOx (80% O_2, 20% CO_2) packaging for 0 d, 2.5 d, 5 d, 7.5 d, 10 d of retail display. Meat colour was measured after each package time point and cooking/purge loss were measured after 0 d, 5 d and 10 d display. Statistical analysis was performed using SPSS Statistics 19 software. Single factor general linear model procedures were undertaken followed by Tukey's honest significant difference test for multiple comparisons (95%). Meat quality attributes were analyzed for the main effects of breed, temperature, and all interactions.

Results

There was no effect of HS or breed on retail meat quality meat lightness and yellowness, but HS increased the Redness(a*) value for 2nd cross lambs over 2.5 to 10 d of retail display (Figure 1). The 2nd cross HS, but not Dorper HS, lambs, had redness (a*) values above the acceptance threshold of 14.8 [5] after 5 d display.

HS significantly increased cooking (0 d) and purge loss (5 d) of Dorper lambs but had no effect on meat from 2nd cross lambs (P<0.05, Figure 2).

Conclusion

When finished under HS conditions, Dorper lambs had higher cooking (o day) /purge (5 day) loss when compared to Dorpers under TN conditions (P<0.05) at 0 days. At 0-5 days post-mortem, the 2nd cross lambs were intermediate for cook/purge loss relative to the Dorper HS and TN and not different (P>0.05 for all). 2nd cross lambs, however, 2nd cross lambs demonstrated better meat retail colour stability after 2.5 d and 5 d display. In conclusion, the effect of HS on meat quality varies between breed. Dorpers subjected to HS show reduced water-holding capacity post-mortem (increased water loss) but this was not evident in the 2nd cross. Heat stress generally caused increased redness in the muscle during retail display and this was accentuated in the 2nd cross lambs.

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Notes

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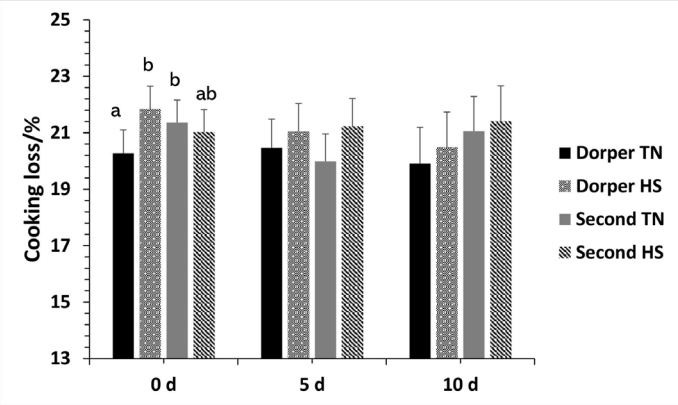

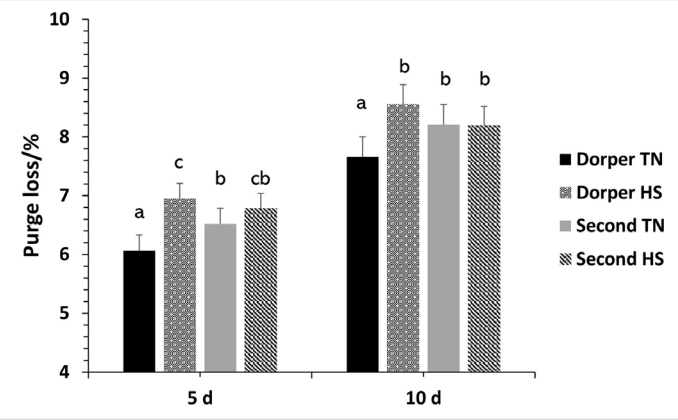

0 d- 10 d cooking loss- treatment $P>0.05$, breed $P>0.5$, treatment×Breed $P>0.05$;
5d purge loss- treatment $P<0.01$, breed $P>0.5$, treatment×Breed $P>0.05$;
10 d purge loss- treatment $P>0.05$, breed $P>0.5$, treatment×Breed $P>0.05$.
[a,b] Means with different superscripts differ significantly ($P<0.05$).

Figure 2. The effect of heat stress on cooking and purge loss of 2nd crossbred and dorper lambs *longissimus lumborum* muscle.

Table 1. The effect of heat stress on meat redness (a*) and storage pH of 2nd crossbred and dorper l N.S.=No significant *** $P<0.01$, *$P<0.05$ [a,b] Means with different superscripts differ significantly ($P<0.05$)

Figure 2. The effect of heat stress on cooking and purge loss of 2nd crossbred and dorper lambs long0 d- 10 d cooking loss- treatment $P>0.05$, breed $P>0.5$, treatment×Breed $P>0.05$; 5d purge loss- treatment $P<0.01$, breed $P>0.5$, treatment×Breed $P>0.05$; 10 d purge loss- treatment $P>0.05$, breed $P>0.5$, treatment×Breed $P>0.05$. [a,b] Means with different superscripts differ significantly ($P<0.05$).

Table 1. The effect of heat stress on meat redness (a*) and storage pH of 2nd crossbred and dorper lambs *longissimus lumborum* muscle.

	Redness (*a**)					Significance		
	Dorper		2nd cross			Temperature	Breed	Temperature×breed
	TN	HS	TN	HS	SE			
0 d	16.4	16.4	16.3	16.6	0.363	N.S.	N.S.	N.S.
2.5 d	16.9[a]	17.2[ab]	16.4[a]	17.8[b]	0.394	***	N.S.	*
5 d	12.8[ab]	13.5[ab]	12.2[a]	15.1[b]	0.840	*	N.S.	N.S.
7.5 d	11.0[a]	11.7[ab]	10.3[b]	13.3[c]	0.908	***	N.S.	N.S.
10 d	9.1[a]	8.1[a]	8.1[a]	10.6[b]	0.551	N.S.	N.S.	***

N.S.=No significant
*** $P<0.01$, *$P<0.05$
[a,b] Means with different superscripts differ significantly ($P<0.05$).

Notes