EFFECTS OF INFUSING NITRIC OXIDE DONORS AND INHIBITORS ON PLASMA METABOLITES AND MEAT QUALITY CHARACTERISTICS OF LAMBS FED A HIGH QUALITY ROUGHAGE-BASED DIET

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Nitric oxide (NO) is a signalling molecule that regulates processes such as force production, blood flow, metabolism, calcium homeostasis and proteolysis in skeletal muscle. Due to the multi-faceted effects of NO in skeletal muscle, it is postulated that altered levels of NO may affect physiological processes that influence meat quality. In previous experiments it was observed that L-NAME (L-arginine methyl ester hydrochloride; inhibitor of NO synthase) infusion increased glycogenolysis and improved tenderness of meat in lambs (Cottrell *et al.* 2002). The present study extended these observations by considering the effect of an NO donor (L-Arginine) and NO inhibitor (L-NAME) on meat quality.

Forty second-cross ((Merino x Border Leicester) x Poll Dorset) wether lambs weighing 43-45 kg were acclimatised in a paddock to a lucerne hay and lamb pellet diet. The flock was divided into 4 groups, and each group was housed in sheltered individual pens over 4 consecutive weeks, and fed *ad libitum* amounts of lucerne chaff and lamb pellets (~250 g/day). In a 2 x 2 factorial design, lambs were randomly assigned to 1 of 4 treatments: Control (30 mL 0.9% NaCl); L-Arginine (NO donor; 500 mg/kg body weight); L-NAME (30 mg/kg body weight) and L-arginine x L-NAME. The bolus concentrations were determined from previous studies where significant changes in plasma metabolites and meat tenderness were observed (Cottrell *et al*. 2003, and unpublished data). Blood samples were taken at -60, -30, -1, 30, 60, 90, 120, 150 and 180 min relative to infusion. Lambs were slaughtered 195 min post-infusion and samples of *longissimus lumborum* (LL) and *semimembranosus* (SM) were collected at 1 and 3 days post mortem for meat quality assessment. All data were analysed for main effects and L-arginine x L-NAME interactions using a general ANOVA, with blocking based on the experimental day and individual lamb.

Table 1. The effect of L-arginine and L-NAME on plasma glucose, lactate and NOx concentrations, and on Warner-Bratzler peak shear force (WBSF, kg/cm^2) for the LL and SM at 1 and 3 days post mortem (see the text for details).

	Control	L-arginine	L-NAME	L-arginine x L-NAME	s.e.d. (L x A)	P-Value		
						L-arg	L-NAME	L-arg x L-NAME
Plasma NOx[A] (μM)	10.09	12.43	11.05	10.85	1.04	ns	ns	0.10
Plasma glucose (mM)	4.0	4.1	4.0	4.1	0.17	ns	ns	Ns
Plasma lactate (mM)	0.36	0.37	0.31	0.37	0.03	0.08	0.06	0.08
1 day WBSF -LL	5.94	5.69	6.33	6.69	0.416	ns	0.02	Ns
3 day WBSF -LL	5.30	5.12	5.63	5.84	0.42	ns	0.09	Ns
1 day WBSF -SM	4.59	4.43	4.53	4.67	0.25	ns	ns	Ns
3 day WBSF-SM	3.68	4.00	4.29	4.16	0.30	ns	0.08	Ns

[A] NOx, total concentration of plasma nitrate and nitrite.

While no treatment effects were seen on the total concentration of nitrate and nitrite, or and glucose concentrations, trends for L-NAME to lower, and L-arginine to elevate, plasma lactate concentrations were observed (Table 1). Higher Warner-Bratzler Shear Force (WBSF) values were observed in the LL at 1 and 3 days post-slaughter, and in the SM at 3 day post-slaughter in the L-NAME treatment, indicating tougher meat. In conclusion, infusion of L-NAME increased meat toughness independently of changes in circulating plasma NO_x concentrations.

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