Administering anti-inflammatory dexamethasone or fish oil mitigated components of the inflammatory response to chronic heat stress and improved average daily gain in whether lambs

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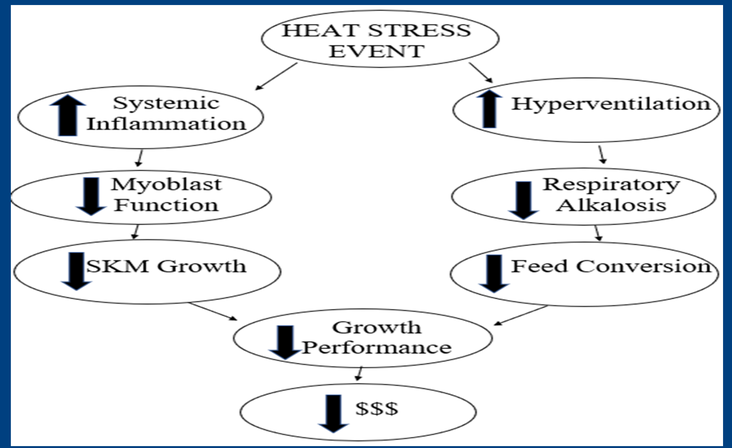
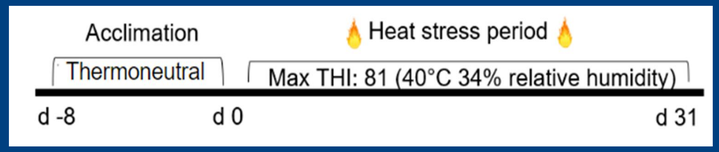
Introduction

- Heat stress has been estimated to costs the livestock industry $2.4 billion annually.[5]
- Heat stress decreases average daily gain, feed efficiency, and carcass weights and increases incidence of morbidity and mortality in livestock.[1]
- Previous studies have determined that non-nutritional factors affect metabolism and growth performance in heat stressed livestock.[4,6]
- Chronic systemic inflammation has been identified as possible culprit of this decrease in growth performance due to documented interactions of pro-inflammatory cytokine with physiological pathways associated with muscle growth.[3]
- Hyperventilation has similarly been correlated with decreased feed conversion due to its induction of respiratory alkalosis in ruminant livestock.[2]
- Therefore, our objective was to determine whether supplementing anti-inflammatory agents to heat stressed wether lambs reduces circulating cytokines and modulates hyperventilation in order to mitigate heat stressed induced deficits.



Experimental Design

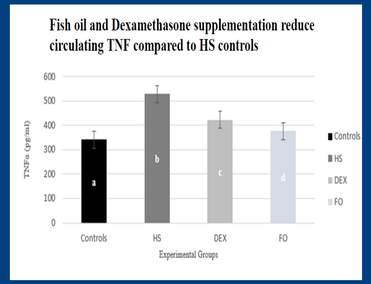
- Thermoneutral: 25°C and 25% relative humidity
- Dexamethasone / placebo injection every 72 hours
- Daily Omega-3 Polyunsaturated Fats (Fish oil; FO) / placebo bolus
- Respiration rate and rectal temperature taken at peak heat
- Blood was collected via jugular venipuncture on d -3, 3, 9, 21, 30 and at necropsy

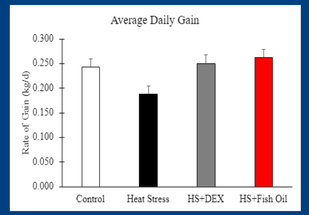


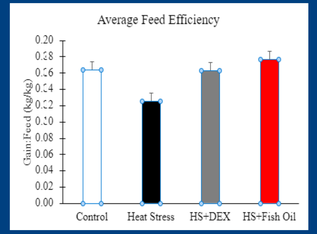
Results

Table 1. Fish oil and Dexamethasone partially mitigate circulating WBC levels HS controls

Parameter	Controls	Heat stress	Dexamethasone	Fish Oil	P-value
White blood count, cells/µl	6.56 ± 0.13[a]	6.57 ± 0.22[a]	7.08 ± 0.17[b]	6.44 ± 0.13[a]	<0.001
Lymphocytes, cells/µl	3.73 ± 0.08[a]	3.31 ± 0.09[b]	3.54 ± 0.11[a]	3.65 ± 0.08[a]	<0.001
Monocytes, cells/µl	0.48 ± 0.01[a]	0.54 ± 0.02[b]	0.54 ± 0.02[b]	0.50 ± 0.01[a]	<0.001
Granulocytes, cells/µl	2.4 ± 0.1	2.7 ± 0.14	3.1 ± 0.1	2.3 ± 0.1	NS







Conclusion

- Heat stress directly induces systemic inflammation, hyperventilation, and growth hindrance in wethers, suggesting non-nutritional factors impact metabolism and animal well being
- Anti-inflammatory supplementation mitigates circulating cytokine count and respiration rate when compared to HS wethers but not controls.
- Anti-inflammatory supplementation is correlated with improvement in average daily gain when compared to HS wether lambs and is comparable to ADG of controls.
- The impact on blood parameters, respiration rate, and average daily gain does not differ between DEX and FO wether lambs during a 30-day supplementation period
- These data indicate that anti-inflammatory agents can improve metabolic, growth, and animal well being parameters in HS wether lambs during a 30-day period
- Further investigation into effect of supplementation length, impact on meat quality, and cost benefit analysis are warranted.

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