

BLOOD FLOW THROUGH THE SKIN IN RELATION TO STAPLE STRENGTH IN MERINO SHEEP

A.N. THOMPSON and P.I. HYND

Dept of Animal Science, University of Adelaide, Waite Campus, Glen Osmond, S.A. 5064

It is generally accepted that differences in staple strength (SS) between sheep are associated with differences in the rate and/or extent to which wool growth changes in response to fluctuating environmental conditions. These differences in wool growth may be associated with changes in the supply and/or uptake of nutrients from the blood, and/or the efficiency with which absorbed nutrients are utilized by the follicle. Blood flow through the skin is a component of nutrient supply. The aim of this experiment was therefore to test the hypothesis that differences in SS between sheep are associated with differences in the rate of blood flowing through the skin.

Twenty Merino weaners (liveweight ($\pm$ s.e.m.) 33.2 ± 0.58 kg) from the "Plus" (+SS) and "Minus" (-SS) SS lines (WA Dept of Agriculture) were individually housed indoors. Following a period of liveweight gain (180 g/day for 55 days), sheep within each selection line were allocated to dietary regimes: (i) liveweight maintenance (days 56 to 280) ($n = 6$); (ii) liveweight loss (50 g/day; days 56 to 168) and liveweight gain (50 g/day; days 168 to 280) ($n = 7$); or (iii) liveweight loss (100 g/day; days 56 to 168) and liveweight gain (100 g/day; days 168 to 280) ($n = 7$). Between days 280 and 343 all sheep were fed to maintain liveweight. Midside patches were clipped at 2 weekly intervals to measure rates of wool growth, and SS (adjusted to 75% yield) was measured by ATLAS on 10 staples taken from the midside of each sheep at the end of the experiment. A laser doppler velocimeter was used to estimate blood flow on days 134, 163 and 164.

Analysis of variance indicated that time of measurement had a significant ($P < 0.01$) effect on the rate of blood flow through the skin. This is consistent with the key role that blood flow plays in thermoregulation, and indicates that blood flow measurements need to be made over several days. There were significant differences in blood flow and SS, but no difference in wool growth rate between selection lines. Blood flow, wool growth and SS increased with improved nutrition; the differences being substantially greater than those between selection lines. Regression analysis indicated a positive linear relationship between blood flow and SS ($r^2 = 0.16$, $P < 0.01$).

Table I. Mean blood flow (mL/minute.100 g tissue), wool growth rate (mg clean/cm².day) and staple strength (N/ktex) of sheep from the "Plus" (+SS) and "Minus" (-SS) staple strength selection lines at 3 levels of nutrition

Character	Selection line				Dietary regime				
	-SS	+SS	s.e.d	Sig.	i	ii	iii	s.e.d	Sig.
Blood flow	4.53	5.24	0.185	***	5.59	4.67	4.40	0.234	***
Wool growth	0.55	0.55	0.046	n.s.	0.92	0.43	0.31	0.059	***
Staple strength	21.45	26.66	2.496	*	33.17	22.12	16.87	3.156	***

* $P < 0.05$, *** $P < 0.001$.

We therefore conclude that the results support the hypothesis that differences in SS between sheep are associated with differences in the rate of blood flowing through the skin. This relationship may be partly explained by effects on wool growth; when selection line and nutrition effects were combined, blood flow was related to wool growth ($r^2 = 0.14$, $P < 0.01$). Nevertheless, variation in SS between selection lines was not due to differences in wool growth, suggesting that blood flow may be associated with a fibre characteristic which influences SS independent of effects on wool growth rate.

This work is funded by the Wool Research and Development Corporation, and the authors wish to thank Prof. B.J. Gannon, Flinders Medical Centre for providing the laser doppler velocimeter.