BLOOD FLOW, BLOOD pH AND CO_2 OUTPUT ACROSS THE HIND-LIMB MUSCLES OF WORKING RUMINANTS

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In working animals, increased blood flow is required by contracting muscle for aerobic metabolism and also by skin to assist in the dissipation of increased metabolic heat load induced by work. This conflict of requirements is an important consideration in draught animals. This communication reports on the effect of work on blood flow, blood pH and CO_2 output across the hind-limb muscles of cattle and buffaloes.

Four steers and four buffaloes were used in a switch-over experimental design where measurements were taken on each animal when it was both fat and thin. The animals were each surgically prepared with indwelling catheters in an external jugular vein, lateral saphenous vein and femoral artery to facilitate arterio-venous (A-V) concentration difference measurement. Blood flow through the muscles was measured using the technique described by Oddy et al. (1981). Measurements on each animal were made before work and during the second hour of work which involved the animal walking on a treadmill at 2.5 km/h and pulling a draught load of 33 kg.

Blood flow through muscles (mean $\pm$ SE ml/min/100 g) in resting and working steers and buffalo were 4.90 $\pm$ 0.893 and 10.65 $\pm$ 2.116, and 6.20 $\pm$ 0.947 and 14.69 $\pm$ 3.687, respectively. Since there were no significant differences between steers and buffalo in the parameters measured, the data were pooled for analysis. The results are shown in the Table below.

Hind-limb muscle		Thin		Fat		P
		Rest	Work	Rest	Work	
Blood flow (ml/min/100 g)		5.09[a]	11.93[b]	6.30[a]	13.46[b]	0.01
pH	A	7.41[a]	7.53[b]	7.45[a]	7.58[b]	0.001
	A-V	0.041[a]	0.071[b]	0.026[a]	0.088[b]	0.001
CO_2	[V]	26.5	29.6	28.5	30.8	0.131
	[V-A]	2.07	2.22	2.04	3.05	0.188

A, V and [ ] indicate arterial and venous blood and concentration, respectively.
In each row, values with different superscripts differ significantly (P<0.05).

Work was the only treatment that had a significant effect on the parameters measured in that it increased muscle blood flow by 134 and 114% in thin and fat animals, respectively. There were also increases A-V differences of blood pH across the hind-limb muscle beds of the same thin (73%) and fat (238%) animals. The increase in oxidative metabolism in working muscles was not reflected in any significant change in CO_2 veno-arterial concentration difference. It would appear that any differences in quantitative metabolism between muscles of thin and fat cattle or buffaloes, or between cattle and buffaloes, would be more a function of A-V concentration differences than of blood flow. Differences between working and resting muscles, however, appear to be more a function of blood flow than of A-V concentration differences.

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