CONTINUOUS MEASUREMENT OF ENERGY EXPENDITURE OF FINISHER PIGS AT RAISED AMBIENT TEMPERATURES

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Previous studies of the effects of ambient temperature on the energy expenditure of growing pigs have been confounded by the opposing effects of reductions in both food intake and activity, which lower oxygen consumption (Q_{02}), and raised respiration rate (RR), which increases Q_{02}. In this study Q_{02} in finisher pigs was measured by the Fick technique (Giles et al. 1989) and voluntary food intake (VFI), RR, rectal temperature (RT) and heart rate (HR) were recorded. Q_{02} was measured continuously by monitoring both cardiac output (CO) using transit-time ultrasound (Transonic Systems Inc., Cornell, New York) and mixed venous blood 0_2 saturation ($Sv0_2$) using fibre-optic technology (Oximetrix: Abbott Laboratories, North Chicago, USA).

Four female pigs (mean liveweight 70 kg) were housed in metabolism crates at 22°C, with food (commercial pelleted diet estimated to contain 14MJ DE/kg) and water provided ad libitum. Each pig was surgically prepared with a Transonic probe around the pulmonary artery to monitor CO and a polyvinyl catheter in the femoral artery. After resumption of food intake in 3 to 7 days, an Oximetrix catheter was placed in the pulmonary artery via the right external jugular vein using an 'introducer set' (William A. Cook, Australia P/L, Brisbane). CO and $Sv0_2$ were monitored at five minute intervals (Tain Electronics, Melbourne). Arterial 0_2 saturation and blood haemoglobin content were measured photometrically (Haemoximeter: Radiometer, Copenhagen) from blood samples collected at intervals of 8 h to calculate the arteriovenous (AV) difference in blood 0_2 content. The pigs were progressively exposed to 31, 25 and 28°C for 48 h (day 1 and 2) with four days at 22°C between each raised temperature treatment. RT, RR and HR were recorded manually at intervals of 1h. Measurements were recorded at 22°C for 24 h prior to each raised temperature treatment as a thermoneutral control and as a covariate adjustment of the mean 24 h results, as shown below. Mean liveweight increased during the raised temperature treatments from 80.0 kg at 31.4°C to 93.9 kg at 28.5°C.

Temperature (°C)	22.7	25.9		28.5		31.4		SEM	
Day		1	2	1	2	1	2	1	2
VFI (g/day)	2846	2429	2370	2145	1888	1019	900	391.0	415.8
CO (l/min)	9.3	9.3	9.5	9.1	8.4	8.7	7.5	0.41	0.46
$AV0_2$ (ml/100ml)	5.4	5.1	5.0	4.9	5.2	5.0	5.2	0.11	0.08
Q_{02} (ml/min)	511	480	464	429	433	446	371	18.2	29.3
RT (°C)	39.3	39.5	39.5	39.7	39.9	40.5	40.9	0.26	0.36
RR/min	27	55	51	89	85	159	112	28.5	18.7
HR/min	111	108	110	99	97	101	95	2.8	4.2

The results indicated that the major factors affecting Q_{02} response to raised ambient temperatures were a decline in VFI and a rise in RR. The initial decline in $AV0_2$, indicating reduced activity, was followed by a rise in $AV0_2$ as respiration rate increased above 28.5°C. CO fell above 25.9°C. Acclimatisation to raised ambient temperature on day 2 included a continued decline in VFI and CO in association with a fall in RR at 31.4°C.

GILES, L.R., GOODEN, J.M., TUCKER, R.G., ANNISON, E.F. and BLACK, J.L. (1989). In 'Manipulating Pig Production II', p.207, eds. J.L. Barnett and D.P. Hennessy. (Australasian Pig Sc. Assoc., Melbourne).

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