FATTY ACID METABOLISM IN FASTED PREGNANT EWES

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The quantitative significance of ketone bodies and nonesterified fatty acids (NEFA) to the energy metabolism of fasted pregnant ewes is poorly understood. Metabolism of specific substrates can be determined in the whole animal by combining the techniques of isotope dilution and open circuit calorimetry (see Linzell and Annison 1975). This report summarises the results obtained from the measurement of NEFA and ketone body metabolism in fasted pregnant ewes.

In this study a total of 17 three-day fasted, 110-130 days pregnant, Clun Forest ewes were placed in an open circuit calorimeter and given an intravenous infusion of 80-150 μCi of $^{14}$C radiolabelled metabolite for 5 h. Steady-state arterial metabolite specific radioactivities were used to determine metabolite entry rate while the steady state specific radioactivity of expired $^{14}$CO$_2$ was used to determine oxidation. The entry rate of total NEFA was similar whether calculated using tracer [l-1$^{14}$C] palmitate (1 sheep), [l-1$^{14}$C] stearate (4 sheep) or [l-1$^{14}$C] oleate (4 sheep). This suggests that in fasted pregnant ewes the individual fatty acids are mobilised and utilised similarly, relative to arterial concentration. Ketone body entry rate and oxidation were determined using tracer [u-1$^{14}$C] D-3-hydroxybutyrate (7 sheep) or [3-1$^{14}$C] acetoacetate (2 sheep) and analysed by a compartmental model to overcome the extensive, but incomplete interconversions of the two ketones (see Barton 1980).

The mean (±S E ) concentrations of plasma NEFA and blood D-3-hydroxybutyrate and acetoacetate were 1.59±0.20 mM, 2.72±0.46 mM and 0.5±0.05 mM respectively. Carbon flow rates of NEFA, ketones (assuming that ketones are derived totally from NEFA) and $^{14}$CO$_2$ are shown below.

Carbon flow of NEFA, ketone bodies and $^{14}$CO$_2$ in fasted pregnant ewes (mAt. carbon/hr/kg body weight)

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\begin{align*}
\text{NEFA} & \downarrow 11.29 \downarrow \text{CO}_2 \\
9.61 & \downarrow \text{ketones} \\
3.51 & \downarrow 5.72 \\
3.98 & \downarrow 3.45 \\
0.54 & \downarrow 3.10
\end{align*}
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Some 58 per cent of the total $^{14}$CO$_2$ production arose from the oxidation of NEFA. Thus, NEFA must be regarded as a major energy fuel in fasted pregnant ewes. Although some NEFA entered nonoxidative pathways, most of it was oxidised (74%) in approximately equal proportions either directly, or via ketones.


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