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Effects of portal infusions of methionine on plasma concentrations and estimated hepatic balances of metabolites in underfed preruminant calves

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The effects of portal infusions of methionine (Met) were studied in 6 preruminant male calves fed a conventional milk replacer in order to allow a daily body gain of 650 g (days 8–15 after birth) except during the experimental period (days 18–25 after birth) when the growth rate was lowered to about 200 g/d (instead of 1 000 g/d at this age) by a 45% restriction in feed allowance. Animals were fitted with catheters in the mesenteric artery (MA), the portal vein and one of the hepatic veins at 8 days of age.

After 5 d of feed restriction, metabolite concentrations were determined in the 3 blood vessels 7 h after the morning feeding with a view to calculating the estimated hepatic balances (EHB) using estimates of blood flows, according to body weight and previous equations (Durand et al., 1988). After a control measurement on day 23, Met was infused in the portal vein for 7 h after the morning feeding at dose 1 (day 24) and dose 2 (day 25). Met allowances were 2.4, 3.0 and 3.6 g/100 g of protein in the milk replacer (control, dose 1 and dose 2, respectively).

Met infusion at dose 2 decreased triglyceride, non-esterified fatty acid and 3-hydroxybutyrate plasma concentrations in the mesenteric artery. The EHB of glucose was significantly increased by this infusion. There was a trend to decrease the apparent captation of triglycerides and to decrease the apparent productions of non-esterified fatty acids and 3-hydroxybutyrate. These results suggest that an increase in Met availability in the energy- and protein-underfed calf can increase hepatic gluconeogenesis, without increasing ketogenesis, perhaps because of a stimulation of triglyceride secretion (thus decreasing the apparent triglyceride capture).


Table I. Effects of methionine (Met) infusions on hepatic metabolism of plasma metabolites.

<table>
<thead>
<tr>
<th>Metabolite</th>
<th>Control MA</th>
<th>Control EHB 2</th>
<th>Met-dose 1 MA</th>
<th>Met-dose 1 EHB</th>
<th>Met-dose 2 MA</th>
<th>Met-dose 2 EHB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glucose 3</td>
<td>0.90</td>
<td>1.5</td>
<td>0.92</td>
<td>1.5</td>
<td>0.87 b</td>
<td>1.9 *</td>
</tr>
<tr>
<td>Triglycerides 3</td>
<td>0.31</td>
<td>-3.7</td>
<td>0.29</td>
<td>0.8</td>
<td>0.21 **a</td>
<td>-0.5</td>
</tr>
<tr>
<td>Non-esterified fatty acids 4</td>
<td>1.40</td>
<td>29.2</td>
<td>1.05 *</td>
<td>0.6</td>
<td>0.55 *</td>
<td>3.2</td>
</tr>
<tr>
<td>3-Hydroxybutyrate 4</td>
<td>0.07</td>
<td>1.0</td>
<td>0.05 *</td>
<td>0.4</td>
<td>0.04 **</td>
<td>0.5</td>
</tr>
<tr>
<td>Urea 3</td>
<td>0.15</td>
<td>0.3</td>
<td>0.15</td>
<td>0.1</td>
<td>0.15</td>
<td>0.4</td>
</tr>
</tbody>
</table>

1 Concentration in the mesenteric artery (n = 6); 2 estimated hepatic balance: apparent production, or (−) capture. Due to failure in the hepatic vein catheter, EHB balances were only available on 5 (control) and 4 (Met-dose 1 and Met-dose 2) calves; 3 mg/ml (MA) or mg/min/kg body weight (EHB); 4 mM (MA) or μmol/min/kg body weight (EHB); *, ** significantly different from control-value, P < 0.11, 0.06, 0.03, respectively; a, b = significantly different from dose 1– value (P < 0.11, 0.03, respectively).