Use of Cobalt-Acetate to Estimate the Endogenous Synthesis of Milk cis-9 trans-11 18:2 in Dairy Ewes Fed Linseed Oil

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Administration of cobalt-acetate may represent a low cost alternative to other more expensive and involved methods used to estimate the endogenous synthesis of milk c9t11-18:2 (a conjugated linoleic acid isomer; Shingfield \textit{et al} 2008; Frutos \textit{et al} 2014). Cobalt inhibits the enzyme stearoyl-CoA desaturase (SCD), which is responsible for the conversion of r11-18:1 to c9r11-18:2 in body tissues (Palmquist \textit{et al} 2005). Using Co-acetate or sterolic acid, Δ9-desaturation was estimated to account, respectively, for 51 or 74% of the c9r11-18:2 found in ewe milk (Bichi \textit{et al} 2012; Frutos \textit{et al} 2014), these inconsistent results being probably due to differences in diet composition rather than in methodological approaches. Thus, although r11-18:1 is produced as a major intermediate with diets rich in either 18:2n-6 or 18:3n-3, the latter minimizes the amount of milk c9r11-18:2 coming from ruminal origin (Loor \textit{et al} 2005), which may affect the relative contribution of Δ9-desaturation to milk c9r11-18:2 secretion.

The aim of this study was therefore to examine, through oral administration of Co-acetate, the endogenous synthesis of milk c9r11-18:2 in sheep receiving a diet enriched in 18:3n-3.

Twelve Assaf ewes fed a TMR (forage:concentrate ratio 50:50) supplemented with 2% linseed oil were allocated to 2 experimental groups and received an oral drench supplying either 0 (Control) or 9 mg of Co (as Co-acetate)/kg of liveweight/day. Treatments were administered in 3 equal doses at 8 h intervals, for 6 days. On days 0 (i.e., before Co-administration) and 6, milk production was recorded and samples were collected for analysis of fat content and fatty acid (FA) composition (Frutos \textit{et al} 2014). Administration of cobalt had no effect on milk yield or milk fat content (P > 0.10) but decreased (P < 0.01) milk Δ9-desaturation ratios, consistent with an inhibition of SCD (Table 1). Changes in the content of c9-10.1, c9-12.1 and c9-14:1 to Co were used as an indication of incomplete inhibition and allowed to estimate that 92% of milk c9r11-18:2 was endogenously synthesized. Cobalt had negligible effects on other milk FA.

Table 1. Effect of oral administration of cobalt on milk yield (kg/d), and fat content (%), major fatty acid (FA) groups (g/100 g total FA) and Δ9-desaturation ratios in milk of lactating ewes

<table>
<thead>
<tr>
<th></th>
<th>Control</th>
<th>Cobalt</th>
<th>s.e.d.</th>
<th>Control</th>
<th>Cobalt</th>
<th>s.e.d.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Milk yield</td>
<td>2.09</td>
<td>2.08</td>
<td>0.098</td>
<td>c9-10:1/10:0</td>
<td>0.038\textsuperscript{a}</td>
<td>0.022\textsuperscript{a}</td>
</tr>
<tr>
<td>Milk fat content</td>
<td>6.03</td>
<td>5.79</td>
<td>0.281</td>
<td>c9-12:1/12:0</td>
<td>0.020\textsuperscript{a}</td>
<td>0.009\textsuperscript{b}</td>
</tr>
<tr>
<td>&lt;C16 FA</td>
<td>35.91</td>
<td>35.02</td>
<td>1.138</td>
<td>c9-14:1/14:0</td>
<td>0.021\textsuperscript{a}</td>
<td>0.010\textsuperscript{a}</td>
</tr>
<tr>
<td>C16 FA</td>
<td>23.50</td>
<td>23.95</td>
<td>0.707</td>
<td>c9-16:1/16:0</td>
<td>0.034\textsuperscript{a}</td>
<td>0.017\textsuperscript{a}</td>
</tr>
<tr>
<td>&gt;C16 FA</td>
<td>40.37</td>
<td>41.25</td>
<td>1.289</td>
<td>c9-17:1/17:0</td>
<td>0.338\textsuperscript{a}</td>
<td>0.232\textsuperscript{a}</td>
</tr>
<tr>
<td>PUFA n-3</td>
<td>1.25</td>
<td>1.17</td>
<td>0.073</td>
<td>c9-18:1/18:0</td>
<td>1.841\textsuperscript{a}</td>
<td>1.216\textsuperscript{a}</td>
</tr>
<tr>
<td>PUFA n-6</td>
<td>2.38</td>
<td>2.34</td>
<td>0.069</td>
<td>c9r11-18:2/t11:18:1</td>
<td>0.505\textsuperscript{a}</td>
<td>0.257\textsuperscript{a}</td>
</tr>
</tbody>
</table>

\textsuperscript{a}Different superscripts within a row indicate significant differences (P<0.05).

Comparison of the estimate of 92% obtained in ewes fed a diet enriched in 18:3n-3 with previous estimates in sheep fed non-supplemented diets (51%; Frutos \textit{et al} 2014) suggests that this high proportion could be related to higher supply of r11-18:1 and lower of c9r11-18:2 of ruminal origin. Basal diet composition would therefore be a major determinant of the relative contribution of Δ9-desaturation to milk c9r11-18:2 content.


This work was funded by MINECO (Spain; AGL2011-23700)

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ANIMAL PRODUCTION IN AUSTRALIA
VOLUME 30

Joint ISNH / ISRP
International Conference 2014
Harnessing the Ecology and Physiology of Herbivores
8-12 September 2014
National Convention Centre
Canberra, Australia

Proceedings of the 30th Biennial Conference of the Australian Society of Animal Production
Published by the Australian Society of Animal Production, 2014

ISSN 0728-5965

This publication primarily contains contributed one-page short communications presented at the First Joint International Symposium on the Nutrition of Herbivores/International Symposium on Ruminant Physiology (ISNH/ISRP) held in conjunction with the 30th Biennial Conference of the Australian Society of Animal Production. Each paper was reviewed by one reviewer and was subject to editorial scrutiny. Invited plenary and four-page papers presented at the conference are published in a Special issue of the journal *Animal Production Science*, Volume 54, Issues x – x.

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