Persistency of the effect of a whey protein emulsion gel on the proportion of poly-unsaturated fatty acids in milk

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Dietary fatty acids and human health

- Unsaturated fatty acids
- Omega 3 fatty acids
- Conjugated fatty acids
Fatty acids in milk

- LCFA Feed
- SCFA Rumen

Diagram showing the distribution of fatty acids in milk, including LCFA and SCFA, with 18:0, 18:1, 18:2, 18:3, 16:0, 16:1, 12:0, 14:0, 8:0, 6:0, 4:0.
Unsaturated fatty acids in rations for dairy cows

- Hydrogenated in rumen
- Inhibit cell wall digestion
  → reduce feed intake
- Reduce milk fat concentration / yield
Fat protection

- Heat treatment
- Formaldehyde treatment
- Gelatinisation
- Soap
- Acyl-amides
Effect whey-protein oil gel on milk fatty acids

- Emulsion of fat, water and protein
- Heated to form a gel
- Heat-treated protein is slowly degraded: fat protected

- Whey soybean oil gel:
  - Doubling milk linoleic acid
  - Doubling milk linolenic acid

(Carroll, et al., 2006)
Effect whey-protein oil gel on milk fatty acids

Questions

- Effect on long term (> 1 week)?
- Supplementation of C18:2 and C18:3?
- Effect of basal diet:
  fresh grass versus silage-based TMR?
Effect whey-protein oil gel on milk fatty acids

Experimental design

- Gel with soybean and linseed oils (21% C18:1, 35% C18:2, 32% C18:3)
- Week 1 to 5: restricted grazing
  Week 6 to 10: silage-based TMR
- 2 Treatment groups (16 dairy cows / group)
  - Control (no supplementation)
  - WPEG 1.5 kg/d
Effect whey-protein oil gel on milk fatty acids

Measurements
- Feed intake and milk yield, daily
- Milk fat, protein and lactose, weekly
- Milk fatty acids, weekly

Statistical analyses
- Mixed model, random RA
## Effect basal diet and **WPEG** on feed intake

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Feeding regimen</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Restricted grazing§</td>
<td>TMR</td>
</tr>
<tr>
<td>Dry matter, kg/d</td>
<td>14.1</td>
<td>22.4</td>
</tr>
<tr>
<td>Crude fat, kg/d</td>
<td>0.2</td>
<td>0.5</td>
</tr>
<tr>
<td>DVE, kg/d</td>
<td>1.2</td>
<td>2.0</td>
</tr>
<tr>
<td>DVE balance</td>
<td>0.62</td>
<td>0.99</td>
</tr>
<tr>
<td>NEL, MJ/d</td>
<td>97</td>
<td>148</td>
</tr>
<tr>
<td>NEL balance</td>
<td>0.64</td>
<td>0.98</td>
</tr>
</tbody>
</table>

§Grass intake excluded!
## Effect WPEG on milk yield and composition

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Control</th>
<th>WPEG</th>
<th>P</th>
<th>LSD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Milk yield, kg/d</td>
<td>34.9</td>
<td>35.0</td>
<td>0.90</td>
<td>1.93</td>
</tr>
<tr>
<td>Fat conc., g/kg</td>
<td>41.6</td>
<td>41.5</td>
<td>0.94</td>
<td>2.85</td>
</tr>
<tr>
<td>Protein conc., g/kg</td>
<td>33.6</td>
<td>33.8</td>
<td>0.62</td>
<td>1.51</td>
</tr>
<tr>
<td>Lactose conc., g/kg</td>
<td>44.9&lt;sup&gt;b&lt;/sup&gt;</td>
<td>46.6&lt;sup&gt;a&lt;/sup&gt;</td>
<td>&lt;0.01</td>
<td>1.00</td>
</tr>
</tbody>
</table>
Effect of WPEG on FA profile in milk fat

Control

All FA ≥ 12:0: P < 0.05

WPEG
“Recovery” of supplemented FA

<table>
<thead>
<tr>
<th>Fatty acid</th>
<th>Supplemented</th>
<th>Extra in milk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Σ C18</td>
<td>29%</td>
<td>29%</td>
</tr>
<tr>
<td>n-6 C18:2</td>
<td>21%</td>
<td>21%</td>
</tr>
<tr>
<td>n-3 C18:3</td>
<td>18%</td>
<td>18%</td>
</tr>
</tbody>
</table>

g/d
Effect of WPEG on proportion of linoleic acid
Effect of WPEG on proportion of linolenic acid

- **WPEG**
- **Control**

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**Graph**

- Y-axis: n-3 C18:3, g/100 g of FA
- X-axis: Week
- Data points show a decrease in proportion of linolenic acid over time for both WPEG and Control groups.

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60th Annual Meeting EAAP, Barcelona, Spain, 24-27 August 2009
**Conclusion**

**WPEG**

- Persistent during 5 / 10 weeks
- Effective technology
- Not yet appropriate for practical application

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