Phosphorus excretion in dairy cows is not affected by forage particle size or rumen degradable protein

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Materials and methods

Design and treatments: 3 dietary treatments during 16 d period. Treatments varied in forage (grass hay) particle size (FPS) and rumen degradable protein (RDP) content:

- **CONTROL**: FPS 30 mm; RDP optimised by adding urea
- **LOW-N**: FPS 30 mm; RDP below requirements, no urea
- **SHORT**: FPS 3 mm; RDP optimised by adding urea

Animals: 36 Holstein cows 222 ± 102 d in milk, 627 ± 7 kg of BW

Diets: Fed ad libitum, 2.5 g P/kg DM, based on the same feeds (% of DM): compound feed (30), corn silage (31), sugar beet molasses (19), grass hay (20)

Fecal excretion and digestibility: 6 grab samples during d 15 and 16. INDF used as marker

Urinary excretion: Semi-quantitative collection by hourly hand-stimulation during 6 h at d 16

Milk: Recorded and sampled at d 15 and 16

Blood sampling: Venopuncture in the tail at d 15

Chewing activity: Jaw movements recorded by a data logger on a head halter for 24 h at d 13 and 14

Results and discussion

Negative P balances and low plasma P confirmed that P was fed below requirement, indicating that effects on fecal P excretion mainly originated from variations in IL of P. Daily chewing time tended to be lower whereas feed and P intake and fecal P excretion was increased with SHORT and none of these were affected by LOW-N, as compared to CONTROL. Digestibility of organic matter was reduced with SHORT and LOW-N as compared to CONTROL. Milk yield was not affected by treatments.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Feed intake, kg DM/d</th>
<th>Milk Yield, kg ECM/d</th>
<th>Chewing time, min/kg DM</th>
<th>Chewing time, min/d</th>
<th>Plasma Pi, mmol/L</th>
<th>P intake, g/d</th>
<th>P in feces, g/d</th>
<th>P in urine, g/d</th>
<th>P in milk, g/d</th>
<th>P balance, g/d</th>
<th>Digestibility of P, %</th>
<th>Digestibility of OM, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>CONTROL</td>
<td>21.6</td>
<td>27.9</td>
<td>36.3</td>
<td>754</td>
<td>0.97</td>
<td>53.1</td>
<td>35.7</td>
<td>0.033</td>
<td>24.6</td>
<td>-7.3</td>
<td>32.6</td>
<td>70.0</td>
</tr>
<tr>
<td>LOW-N</td>
<td>21.0</td>
<td>28.0</td>
<td>28.0</td>
<td>653</td>
<td>1.02</td>
<td>51.9</td>
<td>37.1</td>
<td>0.034</td>
<td>24.2</td>
<td>-9.5</td>
<td>28.3</td>
<td>67.2</td>
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<tr>
<td>SHORT</td>
<td>23.8</td>
<td>30.4</td>
<td>30.4</td>
<td>42</td>
<td>0.86</td>
<td>58.5</td>
<td>42.0</td>
<td>0.038</td>
<td>26.5</td>
<td>-10.1</td>
<td>28.1</td>
<td>65.1</td>
</tr>
</tbody>
</table>

| P-value   |                     |                     |                         |                     |                 |               |               |               |               |                 |                      |
| LOW-N vs. | NS                  | NS                  | NS                      | NS                  | 0.02            | NS            | NS            | 0.003          | NS            | NS            | NS                  |
| CONTROL   | NS                  | NS                  | NS                      | NS                  | 0.10            | NS            | NS            | NS            | NS            | NS            | <0.001              |

Conclusion and implications

Reduced forage (grass hay) particle size (FPS) and rumen degradable protein (RDP) content did not reduce fecal P excretion.

The results of the present study do not support the concept that fecal loss of endogenous P is affected by FPS or by rumen degradable protein supply and thus rumen microbial P incorporation.