# The effect of adding stinging nettle (*urtica dioica*) haylage to a total mixed ration on performance and rumen function of lactating dairy cows

D J Humphries, C K Reynolds
University of Reading, Reading, Berkshire, United Kingdom
*Email: c.k.reynolds@reading.ac.uk*

**Introduction** *In-vitro* studies have identified that the inclusion of dried Stinging Nettle (*Urtica dioica*) at 100mg/g increased rumen pH of a fermentation medium by 30% (Kliem *et al.*, 2005a) and that the effect was persistent for a period of 7 days (Kleim *et al.*, 2005b). These observations indicate that Stinging Nettle has the potential to be used to promote rumen health in animals consuming high levels of readily fermentable carbohydrate by stabilising the rumen environment with respect to rumen pH. Therefore our objective was to evaluate the effects of adding stinging nettle haylage to a high-starch total mixed ration on feed intake, eating and rumination activity, rumen pH, milk yield, and milk composition of lactating dairy cows.

**Materials and methods** Six rumen fistulated lactating Holstein-Friesian cows averaging 20 litres milk/day were used in a replicated 3 x 3 Latin Square design experiment with 3 treatments and 3 week periods. Treatments were a control (C) high-starch total mixed ration (TMR) and two treatment diets containing 5% (N5) and 10% (N10) DM nettle haylage. The control diet contained on a dry matter (DM) basis: 29% maize silage, 10% grass silage, and 61% concentrate blend with minerals. Nettle haylage was included as a direct replacement for the grass silage element of the TMR (DM basis). Eating and rumination activity were measured as described previously by Aikman (2008). Rumen pH was measured using an indwelling pH electrode and rumen VFA concentrations were measured on 9 samples obtained over 8.5 hours. Measurements were made in the last week of each period. The dependent variables were analyzed using Mixed Models procedures and a model testing fixed effects of square, diet, period and diet by period interactions and random effects of cow. Orthogonal contrasts were used to test for linear and quadratic effects of increasing amounts of nettle haylage in the diet. Particle size of the rations was measured using a Penn State Separator.

**Results** There was an increase (linear, $P<0.01$) in the proportion of large particles and a reduction (linear, $P<0.05$) in medium and fine particles with increasing nettle inclusion. A trend for a linear decrease in DMI intake was observed as nettle inclusion in the diet increased (Table 1). Milk yield averaged 20.3 kg/d and was not affected by diet. Ruminating jaw movements declined linearly ($P<0.024$; data not shown) with a corresponding linear decrease in the time spent ruminating as nettle inclusion in the diet increased (Table 1). Rumen pH increased (quadratic) with nettle inclusion in the diet (Table 1). Minimum rumen pH also increased when nettle haylage was included at 10% of ration DM (quadratic). The time that rumen pH was below 5.5, 5.6 and 5.8 was least in cows with a 10% nettle inclusion in the diet and highest for cows with a 5% nettle inclusion (Table 1). There was a tendency for rumen acetate: propionate ratio to increase linearly with increasing nettle inclusion in the diet (Table 1).

**Table 1** Effects of feeding diets containing 5 (N5) or 10 (N10) % nettle haylage on feed intake, rumen pH measurements, length of time rumen fluid was below a specified pH, and rumen acetate:propionate concentration ratio during the last week of each period.

| | Diet | | | | P | | |
|---|---|---|---|---|---|---|---|
| | C | N5 | N10 | SEM | Diet | Linear | Quadratic |
| DM intake, kg/d | 20.0 | 19.7 | 18.5 | 0.93 | 0.220 | 0.106 | 0.593 |
| Time ruminating, % | 25.9$^{a}$ | 20.5$^{ab}$ | 18.7$^{b}$ | 2.56 | 0.175 | 0.080 | 0.525 |
| Mean rumen pH | 5.96$^{a}$ | 6.00$^{a}$ | 6.09$^{b}$ | 0.095 | 0.668 | 0.119 | 0.061 |
| Minimum rumen pH | 5.32$^{a}$ | 5.31$^{a}$ | 5.38$^{b}$ | 0.097 | 0.020 | 0.018 | 0.096 |
| Time (h) pH<5.5 | 3.07$^{ab}$ | 3.30$^{a}$ | 2.50$^{b}$ | 0.994 | 0.059 | 0.292 | 0.152 |
| Time (h) pH<5.6 | 4.86$^{ab}$ | 5.04$^{a}$ | 3.81$^{b}$ | 1.387 | 0.131 | 0.260 | 0.262 |
| Time (h) pH<5.8 | 8.81$^{ab}$ | 8.78$^{a}$ | 7.29$^{b}$ | 2.068 | 0.195 | 0.276 | 0.159 |
| Acetete:propionate ratio | 2.66 | 2.74 | 2.85 | 0.313 | 0.283 | 0.122 | 0.883 |

$^{a, b,}$ Values with different superscripts are statistically different ($P<0.10$)

**Conclusions** Production levels in terms of milk output were maintained when nettles replaced grass silage in the diet of lactating dairy cows, in spite of a reduction in feed intake. Rumination activity was reduced by the addition of nettle haylage to the diet, but there were indications of shifts in rumen fermentation patterns that were potentially beneficial to lactating dairy cows on high grain content diets. Shifts in rumen pH patterns suggest potential benefits of feeding nettle haylage for reducing rumen acidosis. However, it is not certain if the effects observed were due to differences in the chemical composition of grass versus nettles or specific bioactive components of stinging nettles**.**

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**References**

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