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# The effects of ruminal and duodenal casein infusion on dry matter (DM) intake of red clover silage and rumen pool size, digestion and passage kinetics of neutral detergent fibre (NDF)

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The objective of this study was to investigate the effects of casein (300 g Na-caseinate in 6 l of water) infused continuously into rumen (R), duodenum (D) or both (RD) on forage intake, milk yield, chewing activities, rumen pool size and, digestion and passage kinetics of NDF. Control diet (C) consisted of red clover-timothy (75:25) silage fed *ad libitum*. Four ruminally and duodenally cannulated Ayrshire cows in their mid-lactation were used in a balanced 4x4 Latin square. The silage was made as direct-cut, and ensiled with a formic-acid based additive (5.8 l/tn). The silage (CP 168 g/kg DM) was well-preserved as indicated by a restricted fermentation with high sugar (109 g/kg DM), and low of ammonia-N (29 g/kg N) and lactic acid (5 g/kg DM) contents. Chewing activities were estimated by visual observation every 5 min for 24 h. Total collection of faeces was used. Manual evacuation of rumen contents were made on two consecutive days (6:00, 9:30 h) and the mean values were used to calculate rumen pool sizes and digestion kinetics of NDF (Robinson *et al*, 1987, Livest Prod Sci, 17, 37-62). To measure the potential digestibility of NDF of silage, rumen contents and faeces were incubated in nylon bags for 288 h. Yb-labelled silage was used to estimate digesta passage (samples from duodenum and rectum). Non-linear models without (G1G1) or with gamma time dependency (GnG1, n = 2 to 4) in the first compartment were used to estimate digesta passage kinetics. Total mean retention time (TMRT) was calculated as $n/k_1 + 1/k_2$ + transit time (Moore *et al*, 1992, J Anim Sci, 70, 3528-3540).

Ruminal casein infusion tended to increase ($P<0.08$) and duodenal infusion increased ($P<0.05$) silage DMI and milk yield, the responses being almost additive. Total chewing time was longest on D diets but there were no dietary effects on chewing time per kg NDF (mean 140 min) or NDF digestibility (mean 0.566). R diets slightly decreased but D clearly increased rumen pool size of NDF. R diets increased the values of $k_p$ of NDF and $k_d$ of potentially digestible NDF (DNDF) but D diets tended ($P<0.08$) to decrease the value of $k_p$ of NDF. There was no effects on TMRT for duodenal sampling (mean 33.2 h) but for faecal sampling R and D diets both decreased the TMRT values. In conclusion, the increase in silage DMI was associated with faster rates of passage ($k_p$) and digestion ($k_d$) with R diets and with increased rumen fill with D diets.

| Diet | Silage (kg DM) | Chewing (min/d) | NDF dig | NDF pool (kg) | NDF ($k_p$/h) | DNDF ($k_d$/h) | TMRT[1] (h) | TMRT[2] (h) | Milk (kg) |
|---|---|---|---|---|---|---|---|---|---|
| C | 15.1 | 933 | 0.564 | 7.93 | 0.0159 | 0.0369 | 33.3 | 43.0 | 19.5 |
| R | 15.4 | 955 | 0.563 | 7.89 | 0.0164 | 0.0400 | 33.4 | 40.2 | 20.4 |
| D | 15.7 | 1018 | 0.569 | 8.59 | 0.0150 | 0.0360 | 34.4 | 41.0 | 21.2 |
| RD | 16.0 | 975 | 0.566 | 8.16 | 0.0162 | 0.0395 | 31.8 | 39.7 | 21.8 |
| SEM | 0.20 | 12.2 | 0.0068 | 0.074 | 0.00024 | 0.00106 | 0.79 | 0.18 | 0.40 |
| P<0.05 | D | D,RD | | R,D,RD | R | R | | R,D,RD | D |

SEM = standard error of the mean ; sampling site : [1] *duodenum*, [2] *rectum*