

**Compact total mixed ration – effects on feed intake, rumen pH and milk production in dairy cows**

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**Take home message** Decreased sorting possibilities of a total mixed ration (TMR) by increased mixing time and addition of water resulted in decreased feed intake but did not alter the milk production or rumen pH of lactating dairy cows.

**Introduction** When feed is distributed on a feed table with 2-3 cows per meter feeding space, there is a risk that high-ranked cows fed TMR sort and eat the more palatable concentrate parts to a higher extent than the roughage, leaving a less energy dense mix to the low-ranked cows. A way to handle this risk is to make the feed mix more homogenous and dense, by soaking the concentrates and mixing the diet more thoroughly. However, as this results in a decreased particle size, it could possibly result in decreased pH in the rumen. The aim of this study was to evaluate the effects of increased mixing and reduced dry matter (DM) content in a TMR on feed intake, milk production and rumen pH. The hypotheses were that increased mixing and reduced DM would decrease particle size, decrease rumen pH and thus reduce feed intake and milk yield in dairy cows compared with cows fed a traditional TMR.

**Materials & methods** Two dietary treatments were tested in 40 mid-lactation dairy cows, including four rumen cannulated cows, in a change-over experiment with randomized block-design. The two experimental periods consisted of two weeks for adaptation and one week for measurements. The cows were housed in a free-stall barn and milked twice a day. The dietary treatments were; TMR or compact mixed ration (cTMR). Both treatments were mixed and distributed twice daily using the same silage and concentrate with the difference that approximately 30% water was added to the cTMR and it was mixed for 60 minutes whereas the TMR was mixed for 10 minutes. The increased mixing time in cTMR was performed to decrease particle size and increase the homogeneity of the feed. The silage:concentrate ratio was 60:40 on DM basis. The DM content of the silage was 42% and the diet contained (/kg DM) 12.5 MJ metabolizable energy (ME), 187 g crude protein (CP) and 367 g neutral detergent fibre (NDF). The cows had *ad libitum* access to the feed and individual intake of feed and water was recorded using feed mangers on weight scales, with three animals per manger, and water meters in water cups (Biocontrol A/S, Rakkestad, Norway). Particle size was evaluated using the Penn State particle separator (Lammers *et al.*, 1996) with 2 sieves and a bottom pan. Rumen pH was measured manually (MP 125 Mettler Toledo, Schwerzenbach, Switzerland) in the cannulated cows every hour covering a 24h period. Data were analysed with mixed models including block, treatment and period as fixed effects, cow as random effect, and repeated measures within cow modelled by spatial power covariance structures. Data on rumen pH were analysed both as absolute values and as time below pH 5.8.

**Results & discussion** The increased mixing of the cTMR-diet decreased particle size markedly, and the addition of water decreased dry matter from 52 % to 37 %. Total dry matter intake (DMI) was higher in cows fed TMR compared to cows fed cTMR (Table 1). However, milk production was not different between the two diets. Even if intake of drinking water was higher in cows fed TMR, total intake of water was higher in the cows fed cTMR, and the water content of the diet may have been a limiting factor for DMI. Rumen pH or time below pH 5.8 did not differ between the treatments, indicating that the decreased particle size did not reduce buffering capacity in the rumen.

**Table 1** Results of the change-over experiment on 40 lactating cows. Data presented as least squares means.

| Item                          | TMR   | cTMR  | SEM  | p-value |
|-------------------------------|-------|-------|------|---------|
| DM in top sieve (> 19 mm, %)  | 32    | 6     | 1.7  | 0.001   |
| Dry matter intake (kg/day)    | 28.6  | 26.8  | 0.62 | 0.001   |
| Total water intake (kg/day)   | 136.3 | 144.3 | 3.04 | 0.001   |
| Milk yield (kg/day)           | 36.4  | 36.2  | 0.87 | 0.395   |
| Rumen pH                      | 5.8   | 5.7   | 0.11 | 0.638   |
| Time below pH 5.8 (hours/day) | 14.6  | 14.9  | 1.60 | 0.902   |

**Conclusion** Increased mixing time and addition of water to a TMR consisting of grass silage and concentrate (60:40) resulted in decreased particle size of the diet and decreased feed intake but did not have a significant effect on rumen pH or milk production.

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**References**

Lammers BP, Buckmaster DR and Heinrichs AJ 1996. Journal of Dairy Science 79, 922-928.