EFFECT OF SODIUM BENTONITE ON THE PRODUCTIVITY OF LACTATING DAIRY COWS FED GOOD QUALITY PASTURE SUPPLEMENTED WITH A HIGH ENERGY CONCENTRATE

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Two experiments examined the responses of pasture-fed dairy cows to a high energy supplement that included 4.8% sodium bentonite. The results indicated that bentonite did not affect the productivity of dairy cows in either early or late lactation when fed good quality pasture supplemented with varying amounts of high protein pellets. In addition, the use of four rumen cannulated cows in late lactation to provide information of the effect of bentonite on rumen parameters showed that bentonite did not result in any marked buffering capacity nor did it influence nitrogen utilization.

MATERIALS AND METHODS

Two experiments were done in September/October, 1982. In Experiment 1, cows in either early or late lactation were offered 6.5 kg DM/cow/day of good quality pasture (Lotium perenne/Trifolium repens; in vivo DM digestibility in sheep, nitrogen content and neutral detergent fibre of 73.9, 3.31 and 30.6%, respectively). The pasture was supplemented with pellets ranging from 1.8 to 9.6 kg DM/cow/day; the nitrogen content and neutral detergent fibre were 2.50 and 13.0%, respectively. Of the ten cows in early lactation and five in late lactation that were used in Experiment 1, six in early lactation and three in late lactation were offered pellets consisting of 4.8% NaB. The cows were fed in stalls for a 19-day preliminary period followed by 15 days of data collection. They were offered pasture first, at 08.00 and 16.00 h, and the pellets were offered after the pasture was eaten.

Experiment 2 involved four rumen-cannulated cows in late lactation. These were used in a cross-over design; each period was of 15 days duration, the last seven of which animal data were collected. Each cow was offered 6.6 kg DM/cow/day of pasture plus 4.5 kg DM/cow/day of pellets. Cows consumed pellets either with or without NaB. The pasture and pellets were similar to that fed in Experiment 1. The main difference was that the pellets in Experiment 1 contained 2.2% limestone while those used in Experiment 2 did not.

Measurements

(i) Experiment 1. Milk yield, recorded at each milking, the fat content was measured daily and the protein content once each week. Rumen pH.

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was measured at the beginning and end of the experiment.

Samples of the pasture and pellets were collected daily for determinations of DM content, Kjeldahl nitrogen and neutral detergent fibre (Goering and van Soest 1970).

(ii) Experiment 2. From the acid-insoluble-ash (AIA) content of the diet consumed and the AIA content of the faeces, digestibility of the diet of each cow was calculated. Feed and faeces samples were collected twice each day, bulked, and analysed for AIA according to the method of van Keulen and Young (1977).

Rumen ammonia was determined for each animal from samples taken at 16.00 h each day.

Chromium EDTA (Cr-EDTA) was used to mark the liquid phase of the digesta to determine rate of passage (Faichney 1975). A single dose of Cr-EDTA was administered to each cow at 08.00 h on day 9. Samples of rumen fluid were collected at 3, 6, 9, 12, 15, 24, 30, 36 and 48 h after dosing.

The nylon bag technique (Mehrez and Orskov 1977) was used to measure nitrogen degradability of the food. Bags were inserted at 09.00 h on day 11 and retrieved at 1, 3, 6, 9, 12, 24, 48 and 72 h from each animal.

RESULTS

Experiment 1

The results of feeding quantities of pellets ranging from 1.8 to 9.6 kgDM/cow/day in early lactation and 1.8 to 6.1 kgDM/cow/day in late lactation, either with or without NaB, which were analysed by regression analysis, indicated that there were no significant effects of the use of NaB on animal productivity at either stage of lactation. Mean milk yield, fat content and protein content of the cows in early lactation were 20.0 (kg/cow/day) 3.72% and 3.02%, respectively, and rumen pH was 7.32. Cows in late lactation produced 11.9 kg milk/cow/day which contained 4.44% milk fat and 3.46% protein. Rumen pH for these cows was 7.25.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Pellet composition</th>
<th>LSD (P=0.05)</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>-NaB</td>
<td>+NaB</td>
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<tr>
<td>Milk yield</td>
<td>11.1\textsuperscript{a}</td>
<td>10.4\textsuperscript{a}</td>
</tr>
<tr>
<td>Fat composition</td>
<td>5.1\textsuperscript{a}</td>
<td>5.4\textsuperscript{a}</td>
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<td>Protein composition</td>
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<td>4.0\textsuperscript{a}</td>
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<td>Diet digestibility</td>
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<tr>
<td>Rumen ammonia</td>
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<td>18.5\textsuperscript{a}</td>
</tr>
<tr>
<td>Rumen volume</td>
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<td>26.9\textsuperscript{a}</td>
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<tr>
<td>Dilution rate</td>
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<td>15.2\textsuperscript{a}</td>
</tr>
<tr>
<td>Flow rate</td>
<td>199.1\textsuperscript{a}</td>
<td>153.0\textsuperscript{a}</td>
</tr>
</tbody>
</table>

\textsuperscript{a} Values in rows with a common letter do not differ significantly (P<0.05)

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The results of feeding 4.5 kg DM/cow/day of pellets (+NaB) to cows in late lactation are presented in Table 1. Analysis of variance revealed that there were again no significant effects of NaB on dairy cow productivity. As for animal productivity, there were no significant effects of NaB supplementation on any of the rumen parameters measured (Table 1). In addition, nitrogen degradability in nylon bags was not affected by the use of NaB; 85% of total nitrogen had disappeared after 48 h from the feed in both treatments.

**DISCUSSION**

The major result of this experiment was that NaB did not affect the productivity of lactating dairy cows when fed high quality pasture supplemented with varying amounts of high protein pellets. The results indicate that NaB did not show any marked buffering capacity nor did it influence the measured indicators of nitrogen utilization.

NaB has been used as a potential buffering material for ruminants fed high concentrate diets, and it has also been implicated in the utilization of nitrogen. Reports on the effect of NaB on productivity have in general been conflicting. While Bringe and Schultz (1969) and Rindsig et al. (1969) both noted an increase in milk fat content when NaB was added to the concentrate mixture, these studies, plus that of Fisher and MacKay (1983), showed that NaB had no significant effect on intake or milk yield. In addition, data obtained using lambs indicate that benefits from the use of NaB with diets high in concentrates may only occur during the first few weeks of feeding (Huntington et al., 1977a,b; Dunn et al., 1979).

These variations in the effect of NaB on productivity may be due to variations in physical and chemical properties of NaB, which may in turn depend on site of origin. Rumen pH may be used to indicate the usefulness of a material as a buffer. Although Dunn et al., (1979) found that 2% NaB effectively prevented rumen acidosis in lambs, Fisher and MacKay (1983) reported that 3% NaB was not an effective buffer in lactating dairy cows because NaB lowered rumen pH. Ha et al., (1983) too found that 2% NaB had no significant effect on rumen pH, again in lambs. In our experiment, concentrates were introduced gradually and this may have been sufficient to prevent any problems associated with rumen acidosis.

Improvements in nitrogen digestibility and nitrogen retention have been noted with lambs (Colling and Britton 1975), when diets have been supplemented with NaB. In contrast, Rindsig and and Schultz (1970) recorded a depression in nitrogen digestibility without changes in dry matter digestibility or nitrogen retention when NaB was included in the diet of dairy cows. In our study, no significant differences were found in milk protein, rumen ammonia, rumen dilution rate or in nitrogen degradability, the latter determined using nylon bags. Differences may be expected if NaB was either having a nitrogen sparing effect or an influence on nitrogen degradibility in the rumen.

Even if NaB had resulted in nitrogen sparing effect in the rumen in our experiment, there still my not have been any productive advantage because of the very high level of nitrogen in the diet (2.98% in Experiment 2). It is suggested that improvements in nitrogen utilization may only be realized in situations in which nitrogen is limiting.
ACKNOWLEDGEMENTS

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REFERENCES