EFFECT OF HAY OR GRAIN SUPPLEMENTS ON THE MILK PROTEIN PRODUCTION FROM COWS GRAZING GREEN OATS

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Summary

Friesian cows were grazed on green oats and fed grain and hay supplements. All cows received diets estimated to be similar in digestible energy and digestible crude protein content. The four treatment groups received their digestible energy intakes from the following sources (1) 10% green oats, (2) 82% green oats and 18% hammer-milled barley, (3) 82% green oats and 18% pasture hay, and (4) 82% green oats, 9% pasture hay and 9% hammermilled barley.

Cows receiving barley compared to cows fed an unsupplemented diet produced similar fat but increased milk protein and solids-not-fat yields. Addition of hay alone to the green oats increased milk protein production to a lesser extent than did the feeding of barley. Treatments had no significant effect on the proportions of casein, whey protein and a-lactoglobulin in the protein fraction or the heat stability and rennet coagulation properties of the milk. Live weights of the cows were not significantly altered by the feeding regimes.

I. INTRODUCTION

Due to increased demand for milk protein products, the effect of the cows' diet on milk protein production needs investigation. Increased milk protein or solids-not-fat production has been recorded from the inclusion of green oats in the ration of dairy cows (Carter et al. 1965, Newbery 1968) but the green oat intake was not measured. Dietary energy intake alone will influence milk and protein yields (Gordin, Volcani and Birk 1971).

This paper describes an experiment in which cows grazing green oats were fed diets estimated to be of similar digestible energy and digestible crude protein content, with hay and/or grain substituting for a portion of the green oat intake. Measurements were made of the production of milk, total protein, protein components, solids-not-fat and fat as well as some processing properties of the milk.

II. MATERIALS AND METHODS

Thirty two grade Friesian cows from the Northfield Research Centre herd were stratified into eight groups on the basis of milk yield, milk composition and stage of lactation. Cows from each group were assigned to one of four treatments which received similar digestible energy intakes supplied by either: (1) 100% green oats; (2) 82% green oats and 18% hammermilled barley; (3) 82% green oats and 18% pasture hay; or (4) 82% green oats, 9% hammermilled barley and 9% pasture hay.

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pasture hay. The diets contained in excess of the calculated digestible energy requirement for maintenance and production under grazing conditions (National Research Council 1971).

During a 14 day preliminary feeding period and a 7 day covariance period, cows were grazed on green oats and fed barley concentrate and hay. Treatment diets were fed for a 14 day pre-experimental period followed by the 28 day experimental period.

The cows, confined in treatment groups by electric fencing, grazed Swan oats for 3 hours after the morning milking and 1 hour after the afternoon milking each day. The oats were initially approximately 40 cm in height with the first node of stems just visible. At the completion of the experiment the oats were approximately 60 cm in height and nearing the "boot" stage of development. The daily green oat allocation to each treatment group was calculated using the dry matter yield of the green oats determined on the preceding day and estimates of digestible energy content of green oats from data collected in previous years. During the covariance and experimental periods, eight quadrats (50 cm x 50 cm) were cut daily from each treatment area, four before grazing and four after grazing to allow estimation of green oat intake. All samples were washed to remove soil contamination, dried at 100°C for 12 hours, weighed and subsampled. Pasture hay and hammermilled barley samples were taken daily and bulked to give a weekly sample. Samples were analysed for in vitro digestible dry matter (Tilley and Terry 1963) from which digestible energy was calculated (Moir 1961). Digestible crude protein was estimated from Kjeldahl nitrogen (Holter and Reid 1959).

Milk sampling, recording and analyses and California Mastitis Test procedures were as described by Radcliffe, Home and Chillingworth (1972). Once weekly, a daily composite milk sample from each cow was analysed for casein (McGann, Mathiassen and O'Connell 1972) and a-lactoglobulin (Fahey and McKelvey 1965). Individual cow samples, bulked proportionately according to treatment, were tested for heat stability (Feagan, Griffin and Lloyd 1966) and rennet coagulation properties (Ellis 1972). Cows were weighed weekly.

Milk and liveweight data were examined by analyses of covariance, intake data by analyses of variance and California Mastitis Test data by Chi-square heterogeneity tests.

III. RESULTS

Estimated digestible energy and digestible crude protein intakes did not differ significantly between treatments (Table 1). Digestible energy intakes did not differ between weeks but digestible crude protein intakes declined significantly (P<0.05) from week 1 to week 2 and week 2 to week 3. The average digestible crude protein intake per cow per day (kg) was 3.25, 2.71, 1.87 and 1.97 for weeks 1, 2, 3 and 4 respectively.

Milk and fat yields did not differ significantly between treatments (Table 1). Protein yields were significantly higher (P<0.05) from cows receiving supplements than from cows receiving only green oats. Cows receiving hammermilled barley produced higher solids-not-fat yields than cows fed only green oats. No significant differences between treatments in milk composition were observed.

Treatments showed no effect on casein, and a-lactoglobulin percentages or on heat stability and rennet coagulation properties.
Analysis of California Mastitis Test data showed no change in the mastitis status of the cows during the experiment. No significant live weight changes were recorded. Final covariance corrected weights (kg) were 510, 536, 536 and 532 for un-supplemented, barley supplemented, hay supplemented and barley and hay supplemented groups respectively.

TABLE 1

Mean daily feed intake, milk production and milk composition of Friesian cows fed combinations of green oats, barley and hay

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Green oats (MJ)</th>
<th>Green oats and barley (MJ)</th>
<th>Green oats and hay (MJ)</th>
<th>Green oats, barley and hay (MJ)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Digestible Energy</td>
<td>283</td>
<td>292</td>
<td>294</td>
<td>287</td>
</tr>
<tr>
<td>Digestible crude</td>
<td>2.40</td>
<td>2.40</td>
<td>2.53</td>
<td>2.47</td>
</tr>
<tr>
<td>protein (kg)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Milk (kg)</td>
<td>13.88</td>
<td>15.39</td>
<td>14.63</td>
<td>15.10</td>
</tr>
<tr>
<td>Fat (kg)</td>
<td>0.55</td>
<td>0.58</td>
<td>0.58</td>
<td>0.55</td>
</tr>
<tr>
<td>Protein (kg)</td>
<td>0.44a</td>
<td>0.51b</td>
<td>0.47c</td>
<td>0.50bc</td>
</tr>
<tr>
<td>Solids-not-fat (kg)</td>
<td>1.27a</td>
<td>1.41b</td>
<td>1.33ac</td>
<td>1.40bc</td>
</tr>
<tr>
<td>*Production per cow</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fat (%)</td>
<td>4.12</td>
<td>3.84</td>
<td>3.96</td>
<td>3.81</td>
</tr>
<tr>
<td>Protein (%)</td>
<td>3.25</td>
<td>3.37</td>
<td>3.26</td>
<td>3.35</td>
</tr>
</tbody>
</table>

*Values covariance corrected to the production and milk composition prior to the imposition of treatments.

+Means in same horizontal rows with different notations are significantly different (P<0.05).

IV. DISCUSSION

Gordin, Volcani and Birk (1971) showed that by increasing the amount of concentrate and consequently energy fed to the dairy cow, milk yield and protein production increased whereas fat production was unaltered. Similar production trends were observed in the present investigations where grain was substituted for green oats in the ration even though the estimated digestible energy and digestible crude protein intakes were similar for all treatments.

Ponsef, Huber and Emery (1970) have suggested that energy concentration in the diet as well as level of energy intake is important in milk protein production. Increasing the grain component of the diet increases rumen propionate production with a resultant increase in the protein content of milk.

Cows fed green oats ad libitum have produced more milk of higher solids-not-fat content than when fed hay and concentrates (Carter et al. 1965). This observed increase in solids-not-fat production may reflect an increased plane of nutrition due to unrestricted green oat intake rather than any compositional effect of the green oats grazed. In the present experiment, where green oat intake was restricted, solids-not-fat production was lowest from cows fed only green oats.
The ratio of protein yield to solids-not-fat yield was similar for all treatments. Since lactose and protein constitute the major portion of solids-not-fat it appears that lactose and protein production were proportionately influenced by the feeding treatments.

The proportions of the protein components were unaffected by the feeding regimes in agreement with the results of Gordin, Birk and Volcani (1973). However, Pousef, Huber and Emery (1970) found that high proportions of concentrate in the ration increased the proportion of \(\alpha\)-casein and \(\beta\)-lactoglobulin. These conflicting observations are probably due to differences in composition and quantity of feeds offered.

These investigations have shown that dietary composition will influence protein and solids-not-fat production when similar quantities of digestible energy and digestible crude protein are fed. Grain concentrate in the diet of grazing dairy cows can increase milk proteins and solids-not-fat production without significantly altering fat production.

V. REFERENCES


