The Effects on Milk Yield and Composition, and Animal Nitrogen and Phosphorus Status, of Offering Early-Lactation Dairy Cows Concentrate Feeds of Differing Crude Protein and Phosphorus Concentrations

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The effects on milk yield and composition, and animal nitrogen and phosphorus status, of offering early-lactation dairy cows concentrate feeds of differing crude protein and phosphorus concentrations

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Introduction

Milk composition is affected by the dietary concentration of crude protein (CP) (Kung Jr and Huber 1983) and minerals such as phosphorus (P) (Wu and Satter 2000). Milk composition has consequent effects on the processing properties of milk (Dillon *et al*. 1997). The objective of this study was to determine the effects of offering supplementary concentrate feeds differing in CP and P concentration to lactating dairy cows in the early lactation period (Feb-May) on milk yield and composition, and on animal nitrogen (N) and P status.

Materials and Methods

The eight-week study took place at Teagasc, Animal and Grassland Research and Innovation Centre, Moorepark, Fermoy, Co Cork, between 29 February and 9 May 2012. Forty eight lactating dairy cows were blocked on calving date, lactation number, milk yield, milk fat and protein concentration, milk solids yield, bodyweight and body condition score. From within block the cows were randomly assigned to one of four treatments: high protein high phosphorus (HPrHP), medium protein high phosphorus (MPrHP), low protein high phosphorus (LPrHP) and low protein low phosphorus (LPrLP). The treatment groups were offered 13 kg DM grass per cow/day. Four kg per cow daily of concentrate feeds were offered, at morning milking. The HPrHP concentrate contained 240 g CP/kg and 5.7 g P/kg; MPrHP 160 g CP/kg, 5.7 g P/kg; LPrHP 80 g CP/kg, 5.7 g P/kg and LPrLP 80 g CP/kg, 0.096 g P/kg. Milk yield was recorded daily and milk composition was recorded weekly. Milk was analysed by mid infrared spectroscopy (MIR) for fat, protein, casein and urea concentration and milk solids yield. Casein number was calculated as the proportion of casein relative to total milk protein concentration. Faecal samples were collected from each cow during week 5 of the study for analysis of P concentration. Blood samples were taken prior to, during week 4 and at the end of the study for analysis of P and blood urea nitrogen (BUN) concentration. Data were analysed using covariate analysis and the PROC MIXED statement of SAS, with terms for week, treatment and the interaction between treatment and week included in the model.

Results

Table 1 presents the milk performance results of the study. Milk yield, milk fat concentration and milk protein concentration were not affected by treatment and there was no treatment x week interaction. Casein number was higher (P<0.05) in the HPrHP treatment than in the other treatments. Milk urea nitrogen (MUN) concentration was significantly effected (P<0.001) by treatment and there was a significant (P<0.001) treatment x week interaction (Fig. 1). The BUN concentration of HPrHP, MPrHP and LPrHP (3.87 ± 0.174; 3.49 ± 0.164; 3.15 ± 0.157 mmol/L) were all greater (P<0.001) than LPrLP (2.45 ± 0.159 mmol/L). In week 8 of the study, blood P was lower (P<0.001) in the LPrLP treatment (0.95 ± 0.065

Table 1. Effect on milk yield and milk composition of offering supplementary concentrates differing in crude protein and Phosphorus concentration to dairy cows in early lactation.

	HPrHP	MPrHP	LPrHP	LPrLP	S.E.	*P*-Value
Milk yield (kg/d)	27.6	27	26.2	27	0.73	NS
Milk fat (g/kg)	44.5	45.4	46.1	42.7	1.41	NS
Milk protein (g/kg)	34	33.5	33.7	33.9	0.53	NS
Milk solids (kg/d)	2.15	2.12	2.07	2.03	0.052	NS
Casein number	78.2a	77.2b	77.4b	77.2b	0.26	*
Milk casein (g/kg)	26.6	26	26	26.1	0.3	NS

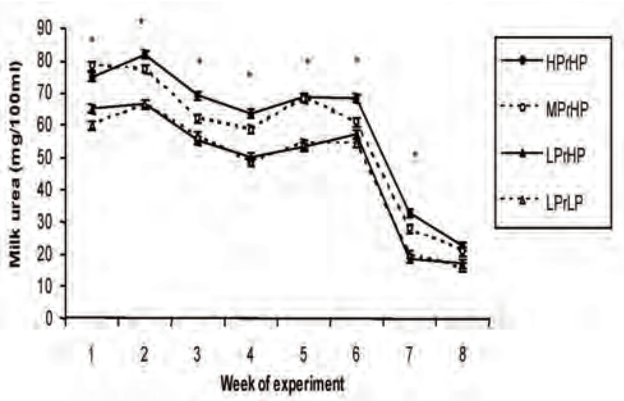

Figure 1. The effect on milk urea nitrogen concentration of offering supplementary concentrates differing in crude protein and phosphorus concentration to grazing dairy cows in early lactation. The asterisks indicate a difference (P<0.05) between HPrHP and LPrHP/LPrLP in week 1 to 7, and between MPrHP and LPrHP/LPrLP in weeks 1, 2, 5 and 7.

mM) than in the HPrHP, MPrHP and LPrHP treatments (1.28 ± 0.063; 1.23 ± 0.071; 1.33 ± 0.062 mM). Faecal P was also lower (P<0.001) in the LPrLP treatment (4.9 ± 0.678 g/kg) than in the HPrHP, MPrHP and LPrHP treatments (6.48, 6.22 and 6.29 ± 0.678 g/kg respectively).

Conclusions

The results suggest that supplementing a grazed grass diet with 4 kg of a supplementary feed containing 80 g/kg CP and 0.096 g/kg P, did not significantly reduce milk yield or milk solids yield. However, it did significantly reduce MUN concentration, which is desirable from a milk processing perspective. Milk urea nitrogen is an indicator of non-protein nitrogen, a component of bovine milk not used in the manufacture of cheese and whey dairy produce (Dalgleish 1993).Casein number, which was highest in the HPrHP treatment, is also important in terms of milk processing, with milk having a higher casein number possessing better processing characteristics. Reducing dietary P significantly reduced faecal P concentration, which can reduce farm-level P output, however, blood P concentration was reduced below the recommended level (NRC 2001). Urinary P was not affected by treatment. Reducing dietary protein (from 240 g CP/kg) significantly reduced MUN concentration without compromising milk yield or milk solids production.

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