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An evaluation of the effect of nutritional strategy in early lactation on performance and energy status of Holstein Friesian dairy cows

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Introduction Improving the sustainability and overall longevity and health of modern Holstein Friesian (HF) dairy cattle is essential in order to maintain overall farm profitability. Prolonged negative energy balance in early lactation can result in metabolic stress, as well as long term problems with fertility (Pryce *et al*., 2004). In addition, maximising the efficiency of nitrogen (N) utilisation by strategies such as reducing the crude protein content of the diet is of crucial importance in minimising the environmental impact of dairying. The aim of this study was to evaluate the effect of a range of nutritional strategies on milk production, energy balance and efficiency of N use in early lactation.

Materials and methods Ninety six HF dairy cows were allocated to one of four dietary treatments immediately post calving. Multiparous animals (n=58) were balanced for milk yield in the previous lactation, parity (mean 2.4), liveweight and body condition score at calving. Primiparous animals (n=36) were balanced for liveweight and body condition score at calving. All diets were offered as a total mixed ration (TMR). The 'Control' diet was formulated using Feed into Milk (Thomas, 2004) to supply 200g starch /kg DM with an overall crude protein (CP) content of 175g/kg dry matter (DM). An 'Individual Cow Treatment' offered a basal TMR of 175g CP/kg DM. Dietary protein content was adjusted on the basis of calculated weekly energy balance, with protein content of the diet reduced to 150g/kg DM (if cows exceeded a pre-determined negative energy balance threshold) or increased to 200g CP/kg DM (if cows exceeded an upper energy balance threshold). A third treatment (High/Low Starch) involved offering a high starch diet for the first 50 days *post partum* (days 1-35 and 36-50 on 200 and 300 g starch/kg DM respectively). From day 51 to 120 *post partum*, animals were offered a low starch (100 g starch/kg DM) /high protected fat (37.5 g/kg DM, calcium salts of palm fatty acids) diet. The fourth treatment (Low Protein) was formulated to contain 150g CP/kg DM, with an additional supplement of 40g/head/day of protected methionine. All diets were offered *ad libitum* and contained concentrate and forage at a ratio of 60:40 with the forage component of the diet comprised of grass and maize silage (60:40). Individual feed intake was measured daily using Calan gates, milk yield and liveweight were also measured daily. Milk composition and condition score were measured weekly. Animals remained on treatment for the first 210 days of lactation. Data were analysed using REML available in Genstat and ANOVA.

Results Dry matter intake, milk yield, milk composition and liveweight change (from calving to 210 days) were not significantly different between treatments (all P>0.05, Table 1). However, daily energy status was affected by treatment (P<0.05) (Table 1), with the Individual cow treatment having the highest average daily energy status compared to the other three treatments (Table 1, Figure 1). In addition, efficiency of N utilisation was significantly different between treatments (P<0.001) with the low protein diet having the most efficient utilisation of N.

Table 1 Treatment effects on animal performance for the first 210 days of lactation

	Control	Indiv. cow	High/Low starch	Low protein	S.E.D.[1]	Significance
Dry matter intake (kg/day)	19.8	20.6	19.7	19.6	0.67	ns
Milk yield (kg/day)	33.5	33.7	34.7	33.4	1.63	ns
Milk composition						
Fat (g/kg)	38.1	39.2	38.4	38.5	1.38	ns
Protein (g/kg)	34.0	34.0	33.8	33.8	0.50	ns
Liveweight change (kg/day, calving-210 days)	0.20	0.14	0.15	0.16	0.06	ns
Milk N/N intake (kg)	0.313^{b}	0.285^{c}	0.336^{b}	0.376^{a}	0.02	***
Daily energy status (MJ/day)	15.4^{b}	28.7^{a}	16.8^{b}	11.9^{b}	5.86	*

[1]S.E.D., standard error of the difference. [2] Significance, ns, P>0.05; *, P<0.05; ***, P<0.001

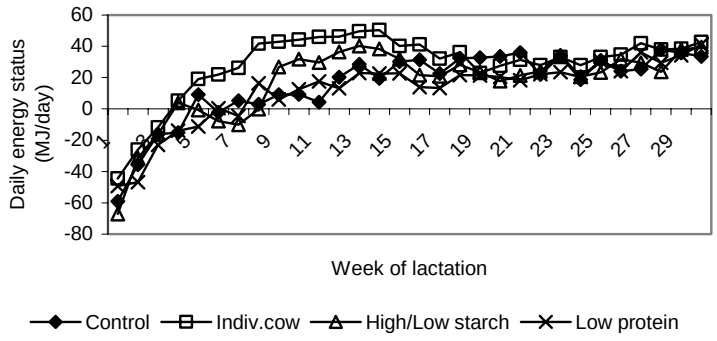

Figure 1 Daily energy status (first 210 days of lactation)

Conclusion Manipulation of individual cow diets in early lactation may help to maintain daily energy status. Reducing the crude protein content of the diet, improved N utilisation with no significant reduction on milk yield or effect on milk composition, however daily energy status was reduced.

Acknowledgments DARDNI and AgriSearch are greatly acknowledged for funding this work

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