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Effect of dietary energy content pre- and post-calving on production and blood metabolites of dairy cows during early lactation

R A Law[1], F J Young[1], D C Patterson[1], D J Kilpatrick[2], A R G Wylie[2], C S Mayne[1]
[1]Agri-Food & Biosciences Institute, Agriculture Branch, Belfast, United Kingdom, [2]Agri-Food & Biosciences Institute, Newforge Lane, Belfast, United Kingdom *Email: ryan.law@afbini.gov.uk*

Introduction The increase in milk production potential of the modern high yielding dairy cow has resulted in excessive and prolonged negative energy balance (NEB) during early lactation. This predisposes the cow to an increased risk of metabolic disorders, poor fertility and subsequently increased culling rates. Historically, much emphasis has been placed on *post partum* nutrition in an attempt to suppress these ill effects. However, contemporary theories advocate improved dry cow nutrition to properly prepare the cow for energy demands of early lactation. Friggens *et al.* (2004) stated that priming the liver during the dry period would allow the cow to better deal with metabolic processes in the *post partum* period. In this experiment, dairy cows were offered different dietary energy levels pre- and post-calving in an attempt to quantify the effects on energy parameters during the same time periods.

Material and methods Forty Holstein heifers and forty Holstein cows (mean parity 3.2) were allocated to one of four treatments, based on a 2x2 factorial design: high or low energy density diet pre- and post calving. From day -80 until day -21 pre-calving, heifers on high and low pre-calving dietary treatments were offered high and low pasture allowances respectively. From day -21 until calving, heifers were housed and offered *ad lib.* or restricted diets (6 kg dry matter (DM)/ day) depending on their respective treatments. The pre-calving treatment for cows commenced 100 days prior to predicted parturition date. All cows were housed and high and low energy diets were offered *ad lib.* From day 42 pre-calving, cows receiving the low energy diet were restricted to 6 kg DM complete diet/ day, while the high energy pre-calving diet continued to be fed *ad lib.* Post calving, treatments were balanced for parity, body weight and date of calving. The concentrate: forage DM ratios of the high and low energy density diets post calving were 70:30 and 30:70 respectively, providing 12.5 and 11.7 MJ ME/ kg DM. Consequently, there were four treatment groups; AH, AL, RH and RL.

Results Pre-calving, animals allocated a restricted low energy diet and an ad lib. high energy diet had significantly ($P<0.001$) different ME intakes; 68.0 and 95.2 MJ respectively ($P<0.001$; SED, 3.32). Pre-calving dietary treatment had a significant effect on body condition score at calving; on average animals receiving an *ad lib.* high energy diet and a restricted low energy diet had a body condition score (BCS) at calving of 2.70 and 2.49 respectively ($P<0.001$; SED, 0.061). There was no significant effect of pre-calving nutritional regime on plasma non-esterified fatty acids (NEFA) concentrations in the pre-partum period. Animals offered a restricted low energy diet and an *ad lib.* high energy diet had plasma NEFA concentrations of 0.41 and 0.38 (meq/l) respectively (SED, 0.037). The results presented in Table 1 illustrate pre- and post calving dietary influences on energetic parameters in the *post partum* period.

Table 1 Effect of dietary energy content pre- and post calving on *post partum* energetic parameters (0-100 days)

Pre-calving		Ad lib.	Ad lib.	Restricted	Restricted	Pre	Post	Interaction	SED
Post-calving	Parity	High	Low	High	Low				
Milk yield (kg/day)	1	30.0	24.2	27.8	26.0	ns	***	ns	1.52
	2+	36.0	31.9	36.0	30.3				
ME intake (MJ/day)	1	189	146	203	157	ns	***	ns	9.38
	2+	252	199	261	182				
TER (MJ/day)	1	206	178	193	192	ns	***	*	3.79
	2+	244	230	242	222				
CEB (MJ)[1]	1	-1519	-2204	2	-2106	***	***	***	115
	2+	-164	-2441	345	-2453				
Glucose (mmol/l)	1	3.54	3.51	3.66	3.54	*	**	ns	0.058
	2+	3.45	3.29	3.55	3.37				
NEFA (meq/l)[1]	1	0.432	0.451	0.366	0.404	*	ns	ns	0.038
	2+	0.339	0.422	0.282	0.351				

[1] NEFA, Non Esterified Fatty Acids; CEB, Cumulative Energy Balance; TER, Total Energy Requirement

Conclusions The results indicate that a restricted low energy pre-calving diet significantly reduced body reserve mobilisation post calving (indicated by plasma NEFA concentrations) resulting in a more rapid return to positive energy status. This concurs with Grum *et al.* (1996) who suggested that loss of body condition during the dry period reduced body reserve mobilisation post-calving, therefore maintaining liver function. In addition, a restricted low energy pre-calving diet significantly increased plasma glucose levels post-calving, which may also be indicative of improved liver function.

References Friggens, N. C., J. B. Andersen, T. Larsen, O. Aaes, R. J. Dewhurst. 2004. Priming the dairy cow for lactation: a review of dry cow feeding strategies. Animal Research, 53: 453-473.
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