Dry period diet affects

Research

with
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METABOLIC disorders during early lactation are linked to energy intake during the dry period, and controversy arises about whether controlling energy intake during the dry period will compromise cow performance after parturition, researchers A. Pineda, F. Cardoso and J.K. Drackley of the University of Illinois said in a presentation at last month's midwestern section meetings of the American Dairy Science Assn. and American Society of Animal Science.

Pineda et al. said the goal of their study (abstract O104) was to determine if controlling energy intake during the dry period has a negative effect on dairy cow performance during early lactation.

They used 27 multiparous Holstein cows that had been dried off 50 days before their expected calving date and blocked by lactation, bodyweight and body condition score (BCS) before being randomly assigned to one of three dry period diets.

The dietary treatments were: (1) a controlled-energy group (CE) of 11 cows fed a high-fiber diet to supply 100% of National Research Council (NRC) requirements for energy and all nutrients *ad libitum*, (2) a high-energy group (HE) of seven cows fed a diet formulated to supply 160-180% of net energy requirements at *ad libitum* intake and (3) a restricted-energy group (RE) of eight cows fed to 80% of their calculated net energy requirements by controlled intake of the high-energy ration.

After calving, a single lactation diet that supplied 100% NRC requirements was fed to all cows.

Bodyweight and BCS were measured weekly. Milk production and dry matter intake (DMI) were recorded daily. Milk samples were collected twice weekly and analyzed for fat, protein, lactose, milk urea nitrogen (MUN) and somatic cell count. Cows remained in the experiment until 28 days after calving.

Pineda et al. reported that cows fed the HE diet had greater DMI ($P < 0.001$) during the dry period, while cows in the RE group had lower bodyweight ($P = 0.08$). In addition, a significant ($P = 0.02$) treatment-by-week interaction was observed for DMI during the dry period.

Despite no differences in milk production ($P = 0.83$), Pineda et al. said cows fed the CE diet had higher milk protein content ($P = 0.04$) compared to cows fed the RE diet. Fat, lactose and somatic cell concentrations did not differ among treatments. A significant ($P < 0.05$) treatment-by-week interaction was also observed for milk protein and MUN concentrations.

Pineda et al. added that after parturition, cows previously on the CE and RE treatments during the dry period performed similarly to HE cows.

Butyrates

According to K. Herrick and K. Kalscheur of South Dakota State University in abstract O106, research investigating individual volatile fatty acid (VFA) supplementation or intermediates of VFA metabolism has demonstrated their potential as a treatment for metabolic diseases in the postpartum ruminant. That research investigated treatments such as propylene glycol, glycerol or calcium propionate, which are related to glucose and propionate metabolism.

They noted that butyrate may also be a viable energy supplement because of its greater energy content compared to the other major rumen VFAs. However, rapid conversion of butyrate to ketone bodies at the rumen epithelium and in the liver makes it difficult to increase plasma butyrate concentration, Herrick and Kalscheur said.

Therefore, they investigated the performance and metabolic responses in lactating dairy cows that were fed treatments designed to increase rumen butyrate concentration.

In the first experiment, four ruminally fistulated Holstein cows (152.5 days in milk) were ruminally dosed with one of four treatments within a Latin square design: (1) two liters of water, (2) 3.5 g of lactose per kilogram of bodyweight, (3) 1 g of butyrate per kilogram of bodyweight or (4) 2 g of butyrate per kilogram of bodyweight.

Herrick and Kalscheur reported that animal health was not affected by treatment, and there were no changes in DMI or milk production in this experiment.

However, they noted that butyrate treatments decreased plasma glucose and increased plasma beta-hydroxy butyrate and rumen butyrate.

In the second experiment, five ruminally fistulated Holstein cows (94.2 days in milk) were infused for 24 hours with one of five treatments: water (control), 1 g of butyrate per kilogram of bodyweight infused into either the abomasum (A1) or rumen (R1) or 2 g of butyrate per kilogram of bodyweight infused into either the abomasum (A2) or rumen (R2).

Plasma glucose, plasma beta-hydroxybutyrate and plasma butyrate were affected by butyrate addition and treatment dose (Table), Herrick and Kalscheur said (statistics not provided). Butyrate infused into the abomasum increased plasma butyrate more than rumen infusion of butyrate, the researchers explained.

They concluded that butyrate supplementation has the potential to improve the energy balance of lactating dairy cows but included the caveat that the potential negative effects of increased ketone bodies and responses in lipid and carbohydrate metabolism need further investigation.

Effect of infusing butyrate into rumen or abomasum on plasma parameters

	Control	R1	R2	A1	A2
Plasma glucose, mg/dL	73.0	67.2	65.3	69.6	62.1
Plasma beta-hydroxybutyrate, millimoles	615	965	1,454	676	1,235
Plasma butyrate, millimoles	0.08	0.09	0.11	0.10	0.15

Off-flavors

In abstract O034, E.D. Testroet, G. Li, D.C. Beitz and S. Clark of Iowa State University noted that feeding dried distillers grains with solubles (DDGS) to lactating dairy cows has been shown to increase the proportion of unsaturated fatty acids — which are more susceptible to free radical-mediated oxidative damage — in the milk produced by those cows.

Testroet et al. conducted a study to investigate the effect of feeding DDGS to lactating dairy cows on milk production parameters as well as milk oxidative stability and flavor attributes.

In the study, 24 mid-lactation Holstein dairy cows were blocked by parity and days in milk into two groups of 12. The experiment was set up as a three-period crossover design, with three diets — 0%, 10% and 25% DDGS on a dry matter basis — fed *ad libitum* for 28 days, following an initial seven-day acclimation period, the researchers said. Diets were formulated to be isocaloric and isonitrogenous.

Testroet et al. explained that to eliminate a carryover effect, milk was not collected until day 14 of each treatment period, and milk yield data from the first seven days of each treatment period were not included in the statistical analysis.

According to the researchers, milk yield was not significantly affected in cows fed 0% or 10% DDGS (34.03 kg and 34.82 kg per day, respectively) but was decreased to 30.60 kg per day ($P < 0.05$) in cows fed 25% DDGS.

Furthermore, Testroet et al. determined that the 10% and 25% DDGS diets caused ($P < 0.05$) milk fat depression, and there was a concomitant increase in milk protein content ($P < 0.05$). No significant

lactation performance

differences were detected in rumen VFAs ($P > 0.05$) and acetate-to-propionate ratios among the treatments ($P = 0.515$).

Short- and medium-chain fatty acids (C6:0-C15:0), as well as linoleic acid (C18:2), were significantly affected ($P < 0.05$) by treatment, the researchers said, with elevated concentrations of linoleic acid observed in the 10% and 25% DDGS diets.

Regarding the oxidative stability and milk flavor attributes, Testroet et al. said the total antioxidant capacity of milk — a measure of oxidative stability — was not affected by treatment, and no differences in off-flavors were detected in milk from any treatment by a trained sensory panel.

Testroet et al. concluded that dietary DDGS inclusion modified milk composition but did not result in milk that was less oxidatively stable or more prone to development of off-flavors.

Feeding DDGS

In abstract P117, H.A. Ramirez Ramirez and P.J. Kononoff of the University of Nebraska-Lincoln and K. Karges of the Dakota Gold Research Assn. studied ruminal fermentation parameters of dairy cows fed a low-fat DDGS (LF-DDGS) in combination with a rumen inert fat (RIF) as calcium salts of long-chain fatty acids.

Ramirez Ramirez et al. used four lactating, ruminally cannulated Holstein cows that were 98 days in milk and housed in a tie-stall barn. Cows were fed once a day and milked twice daily.

In each 21-day period, cows were randomly assigned to one of four dietary treatments (values expressed on a dry matter basis): (1) a control diet that was a conventional dairy ration containing no corn ethanol byproducts, (2) a diet that contained 30% DDGS, (3) a diet that contained 30% LF-DDGS and (4) a diet that contained 30% LF-DDGS supplemented with 1.9% RIF.

According to the researchers, there was no significant effect on rumen ammonium levels, which averaged 27.9 mg/dL across treatments. Diets 1 and 4 had similar mean ruminal pH values (6.18), whereas diets 2 and 3 resulted in lower pH values (5.87; $P < 0.01$).

Ramirez Ramirez et al. said they did not observe any treatment effect on total VFA concentration, which was 119 mmol per liter, but the molar proportion of acetate was greatest ($P < 0.01$) in cows consuming diet 1, intermediate for diet 4 and lowest for diets 2 and 3 at 67.6, 63.4 and 61.2 mol/100 mol, respectively.

The researchers said they observed an inverse pattern for the molar proportion of propionate: diets 2 and 3 had the greatest ($P < 0.01$), diet 4 was intermediate and diet 1 had the lowest at 23.1, 20.6 and 18.0 mol/100 mol, respectively.

As a result, Ramirez Ramirez et al. reported that acetate:propionate was greatest ($P < 0.01$) in diet 1, followed by diet 4 and then diets 2 and 3 at ratios of 3.8, 3.12 and 2.71, respectively.

Feeding DDGS and LF-DDGS resulted in a modest decrease in the concentration of acetate with a concomitant increase in propionate, thus a lower acetate:propionate ratio, the researchers concluded, noting that these effects were reversed by RIF supplementation.

They said this indicates that high inclusion rates of LF-DDGS can support adequate ruminal fermentation in lactating dairy cows if the diets are supplemented with RIF. ■

In 60 seconds

Feed additive: BASF has launched its Novasil Plus feed additive. This product became directly available from BASF in January 2013. Novasil Plus can be used in two ways, depending on its registration status in each country: as an anticaking agent for enhancing the flow properties of feed or feed ingredients, or for specifically binding aflatoxins. Aflatoxins can occur in all grains, posing huge risks to animal health. Novasil Plus consists of naturally occurring, high-purity calcium bentonite clay, BASF said, noting that it has been available in the market since the early 1990s. BASF acquired the U.S. production site when it bought Engelhard in 2006.

Dairy performance: Agri-King has launched its new Ru-Mend as part of an improved Key Dairy Program. The newly formulated Ru-Mend helps break down fiber and starch, releasing more energy and nutrients. According to the announcement, the product's technology assists in making nutrients more available to the rumen and the cow, which can help improve feed digestibility and feed efficiency. Ru-Mend is available for conventional operations and also is approved for organic use under the name Ru-Mend Special.

Granular formula: Phibro Animal Health Corp. announced that its Terramycin 200 (oxytetracycline) antibiotic is now available as a granular formulation. Terramycin 200 Granular offers a high-potency granular tetracycline that delivers broad-spectrum treatment of diseases, such as bacterial pneumonia and bacterial enteritis, as well as treatment and control of leptospirosis, Phibro said.

Calf stress: AgriLabs announced the introduction of StressMate, a unique product developed from colostrum that provides a source of small proteins commonly referred to as bioactives, which help calves cope with stress. Producers now have an option to treat stressed calves and to help calves exposed to stressful conditions such as birth, commingling, transport or adverse weather. StressMate is packaged in 250 mL bottles and can be fed orally by itself or in milk, milk replacer or electrolyte solution.