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ReaShure®-XC

Precision Release Choline

Balchem Research Summary

Effect of feeding rumen-protected choline on performance, health and reproduction of dairy cows.

A summary of a study conducted by F. S. Lima, M. F. Sá Filho, L. F. Greco and J.E. P. Santos. University California-Davis. Published as ADSA abstracts (2007, 2008), Florida Ruminant Nutrition Conference Proceedings (2009) and The Veterinary Journal (2011).

Background

Balchem now manufactures a high-quality, ruminally protected choline product called ReaShure®-XC *Rumen Protected Choline,* the next generation of ReaShure which provides bioavailable choline in a more concentrated product.

At calving, dairy cows go from a period of positive energy balance to negative energy balance. There is a surge in blood non-esterified fatty acids (NEFA) at calving, due to the stress and the hormonal changes associated with parturition and initiation of lactation. Blood NEFA remains elevated after calving due to the mobilization of adipose tissue (NEFA) to meet the cow's energy needs. A portion of blood NEFA is taken up by liver and oxidized for energy while some is re-assembled into a triglyceride (TG) and exported from the liver as a constituent of very low density lipoproteins (VLDL). The amount of NEFA that can be handled by these two pathways is limited in ruminants; consequently some of the NEFA is partially oxidized resulting in elevated ketones in the blood. Also, since the export of TG via the VLDL is limited, TG will accumulate in the liver, leading to impaired liver function. Providing the transition dairy cow with rumen protected choline has been shown to alleviate fatty liver, presumably by supplying additional choline, an essential component of VLDL. Enhancing TG export from the liver should also reduce the conversion of NEFA to ketones and consequently ketosis.

Objective and Design

A trial was conducted to determine if feeding ReaShure® *Precision Release Choline* during the transition period could improve lipid metabolism, reduce the incidence of clinical and subclinical ketosis and other energy related disorders, and improve the fertility of the cows. The trial was conducted at a commercial dairy in California.

A control diet or one supplemented with 12,9 gr/day/cow of choline ion in a rumen protected form was fed to 369 primi- and multiparous Holstein dairy cows from 25 days prepartum to 80 days postpartum. Cows were housed in pens. Cows were blocked by parity and expected day of calving, and within each block, randomly assigned to treatments. Parameters monitored included pen dry matter intake (DMI), milk production and composition, health, and reproductive status. Cows were evaluated daily to diagnose diseases. Diseases monitored included: retained placenta, metrtitis, displaced abomasum, mastitis, and ketosis (clinical and subclinical) as well as required treatments. Clinical ketosis was characterized by a lack of appetite, depressed attitude and presence of severe ketonuria. Subclinical ketosis was characterized by monitoring plasma beta-hydroxy butyric acid (BHBA) at day 1 and 14 post-calving. Subclinical ketosis was characterized as BHBA levels exceeding 1000, micro mol/L. Body Condition score (BCS) was monitored pre- and postpartum using a scale of 1 to 5. A liver biopsy was collected on a subset of cows in each treatment group between day 7 to 10 post-calving and analyzed for TG. All cows had their estrous cycle presynchronized and then 10 days later cows were enrolled in a timed insemination (AI) protocol. Pregnancies per AI were evaluated at 30 and 65 days after first insemination and at 38 days after the second insemination.

Results

DMI pre-calving did not differ between treatments and averaged 12.5 kg/d (Table 1). After calving, cows fed ReaShure had a higher DMI ($P = 0.10$) than control cows (23.9 vs. 22.6 kg/d). Feeding ReaShure improved 3.5% fat corrected milk (FCM) yield (44.6 vs. 42.8 kg/d) as depicted in Table 1. Milk fat and protein % were not different between treatments; but milk fat and protein yield were increased by ReaShure-XC feeding. Yield of milk fat for ReaShure-fed cows was 1.61 kg/day vs. Control of 1.52 kg/day ($P = 0.05$) and yield of true protein for ReaShure fed cows was 1.21 kg/day vs. 1.17 kg/day for control cows ($P = 0.08$). Cows lost approximately 0.75 units of BCS from enrollment to 90 d postpartum, and feeding ReaShure reduced ($p= 0.01$) BCS losses postpartum.

The incidences of clinical ketosis ($P < 0.01$) and the relapse of clinical ketosis ($P < 0.05$) were also reduced for ReaShure vs. control cows. Prevalence of SCK at day 1 postpartum (as indicated by plasma BHBA) tended to be less ($P < 0.07$) for Reashure than control cows, regardless of parity. At day 14, prevalence of subclinical ketosis was reduced ($P= 0.05$) by feeding ReaShure in the multiparous cows, as indicated by a parity by treatment interaction. From the liver biopsy, if cows had greater than 5% fat in the liver tissue, they were classified as having hepatic lipidosis. Less ($P < 0.05$) of the cows fed ReaShure were classified as having hepatic lipidosis than those in the control group (Table 2).

Feeding ReaShure did not influence the incidence of retained placenta, fever, metrtitis, and displaced abomasum (DA). Feeding ReaShure tended to reduce the incidence of mastitis ($P= 0.06$) and significantly reduced ($P= 0.02$) the number of mastitis cases per cow (Table 2). When considering all of the postpartum health disorders (retained placenta, metritis, clinical ketosis, DA, and mastitis), cows consuming ReaShure experienced lower ($P < 0.001$) morbidity than control treatment cows (Table 2). An interaction ($P= 0.05$) was observed between treatment and parity for cyclic status. Pregnancy at first service was numerically higher for cows fed ReaShure than control but did not reach statistical significance ($P = 0.20$).

Discussion

Fatty liver and ketosis (clinical and subclinical) are metabolic disorders common to transition cows and have been associated with depressed feed intake, lower milk production, poor immune response and reproductive performance, and impaired liver function including depressed glucose production. Therefore, monitoring fatty liver or ketosis can be used to assess transition cow well-being and performance.

In this trial, feeding of ReaShure during the transition period reduced the incidence of hepatic lipidosis. Cows in this treatment group ate 1.3 kg/d more DM than control cows and produced 1.8 kg/d more 3.5% FCM for the first 80 days-in-milk. The lower incidence of hepatic lipidosis in the ReaShure-fed cows was also accompanied by a reduction in the incidence of clinical and subclinical ketosis, mastitis, and overall morbidity vs. control cows. Evidence of an improvement in reproductive status with ReaShure was not statistically significant (P = 0.20); but ReaShure-fed cows had an improved pregnancy rate at first AI. These responses indicate that the cows fed ReaShure were healthier and more productive than control cows.

Table 1. Milk production and composition, and dry matter intake.

	Control		ReaShure		P Value
Milk, lb/d (kg/d)	92.8	(42.1)	95.0	(43.1)	0.09
3.5% FCM, lb/d (kg/d)	94.4	(42.8)	98.3	(44.6)	0.04
ECM, lb/d (kg/d)	84.9	(38.5)	88.4	(40.1)	0.04
Dry matter intake, lb/d (kg/d)	49.8	(22.6)	52.7	(23.9)	0.1
Pre-calving	26.7	(12.1)	28.4	(12.9)	0.46
Post-calving	49.8	(22.6)	52.7	(23.9)	0.1

Table 2. Hepatic lipidosis and incidence of disease.

Item	Control	ReaShure	P Value
Hepatic Lipidosis [1], %	40.5	14.3	0.05
Subclinical Ketosis [2], %			
1 day postpartum	37.2	28.5	0.070
14 day postpartum	29.7	19.9	0.350
Clinical Ketosis, %	11.2	4.0	0.010
Relapse of Ketosis, %	6.8	2.3	0.050
Mastitis, %	22.5	14.7	0.060
All postpartum diseases[3], %	57.1	38.4	0.001

[1]Hepatic triglyceride > 5% wet tissue.
[2]Determined by measuring plasma beta-hydroxy butyric acid (lab test).
[3]Includes retained placenta, metritis, clinical ketosis, displaced abomasum and mastitis.

Conclusion

A significant body of evidence has accumulated to support choline as a required nutrient in transition cow diets. Supplementing transition cow diets with ReaShure *Precision Release Choline* is a proven way to meet the transition dairy cow's dietary choline requirements by protecting choline from rumen degradation and delivering it to the small intestine for absorption. Adequate choline in the diet reduced liver fat accumulation, improved dry matter intake, increased milk yield and reduced the incidence of health disorders in the transition cow.

Sources

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Balchem Corporation
52 Sunrise Park Road, New Hampton, NY 10958 USA
Phone 845-326-5600
anh.marketing@balchem.com
BalchemANH.com

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