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THE NUTRITIONAL CONSULTANT'S DIGEST

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PROCREAM – Nutritional and Health Benefits in Animal Nutrition

Procream is a co-product produced in the microfiltration of whey to produce whey protein isolate (WPI). Other terms used to describe procream include whey cream (WC) reduced lactose concentrated whey or whey protein phospholipid concentrate. Unique properties of procream that make it attractive to animal nutrition are protein (55% – 70%), total (15% – 30%) and composition of fat and mineral content. In addition, procream contains the milk fat globule membrane (MFGM) which has been found to have specific antiviral and anti-adhesion properties that protect neonates from viral and bacterial infections (Fong et al., 2007). Mucin 1 (MUC1) is an immune protein present in MFGM (Reinhardt and Lippolis, 2006), that has protective properties in the intestine, including anti-rotavirus properties (Fuller et al. 2013; Kvistgaard et al, 2004). Bovine MFGM also possesses fatty acid-binding proteins (Fong et al., 2007), that may promote fatty acid transfer across the intestinal tract.

To evaluate the nutrition and potential health benefits of feeding procream to neonatal dairy calves, two research studies were conducted at the University of Minnesota. In the first study (LaBerge et al., 2013a), calf milk replacer containing 0, 10% or 20% WC was fed to 72 dairy calves (24 calves/treatment). Calf milk replacers were formulated to be isonitrogenous (all protein coming from milk products) and isocaloric. Nutrient composition and selected fatty acid composition of calf milk replacers is in Table 1.

Table 1. Nutrient and fatty acid composition of milk replacers

	Milk replacers, % whey cream		
	0	10	20
Dry Matter, %	96.7	96.7	96.7
Crude protein, % DM	21.6	23.8	23.7
Ether extract, % DM	19.5	19.7	19.7
Ash, % DM	9.5	9.3	9.3
Fatty acid, g/100g fatty acid			
Total unsaturated fatty acids	60.4	59.1	57.0
Poly unsaturated fatty acids	19.1	18.3	16.6
C18:0	9.4	9.4	9.4
C18:1	40.8	40.3	39.7
C18:2	18.0	17.3	15.7
C18:3	0.7	0.7	0.6

Calf milk replacer powder was fed at 1.5% of body weight and reconstituted to 13% solids for feeding. Calves were fed milk replacers twice per day until 42 days of age and then at half amounts from 43 days to weaning at 49 days. Calf starter was fed ad libitum to all calves starting at 3 days of age.

Total gain and average daily gain from birth to 56 days of age was not statistically different for calves fed the three milk replacer treatments. However, numerical differences and a trend ($P<0.07$) show calves fed 10% and 20% WC milk replacer grew better during the milk replacer feeding period and the week following weaning than calves fed 0% WC milk replacer (Figure 1). Calves fed milk replacers with WC also had numerically fewer scour days than control fed calves (Figure 1). The trend for healthier and faster growth in WC fed calves may be partial explained by the fatty acid composition of WC and the MFGM. Hill et al., (2007) showed increasing the concentration of short-chain (C4:0), medium-chain (C8:0, C10:0, C12:0, C14:0), and essential fatty acids (C18:3) in milk replacer reduced the number of days with abnormal fecal scores and improved average daily gain (ADG) in calves.

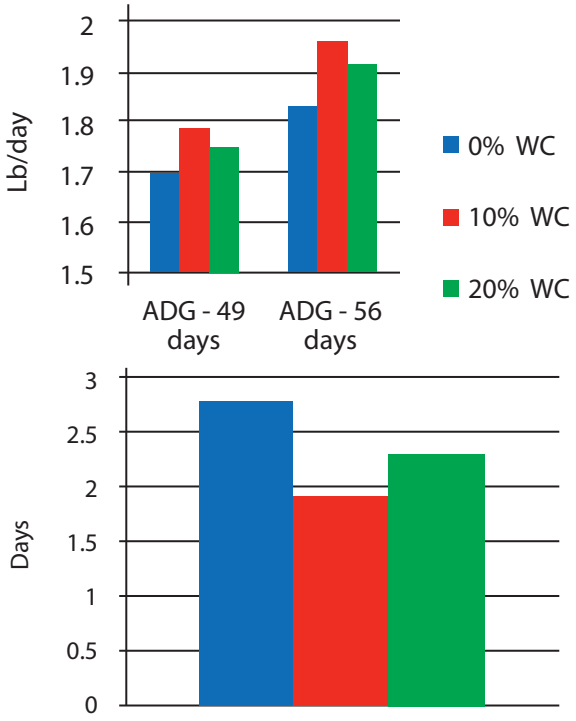

Figure 1. Average daily gain (top graph) and scour days (bottom graph) of calves fed whey cream milk replacers.

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PROCREAM – Nutritional and Health Benefits in Animal Nutrition (continued)

Calves fed 10% and 20% WC milk replacer consumed more calf starter pre- and post-weaning than calves fed control milk replacer (Table 2).

Table 2. Starter intake of calves fed 0%, 10% or 20% whey cream in milk replacer.

	Milk replacers, % whey cream			
	0%	10%	20%	P-value
Total starter intake, lb				
1 to 49 days	86.0	95.7	99.2	0.08
1 to 56 days	134.7	145.8	147.7	0.17

The second study conducted by LaBerge et al. (2013b) looked at gastrointestinal development of calves fed the 3 milk replacers. The increased amount of starter consumed by WC fed calves related to an increase in the weight and length of the small intestine compared to control fed calves (Table 3). Recent information on growing and finishing beef cattle indicate greater small intestine size and growth as a calf improves feed efficiency in the growing and finishing phases. Milk fat globule membrane has been found to improve gut maturation in neonates and in conjunction with anti-viral and anti–bacterial properties (Dewettincka et al., 2008), possibly led to a healthier digestive tract of WC fed calves.

Table 3. Gastrointestinal measurements and average goblet cell count of calves fed 0%, 10% and 20% whey cream in milk replacer.

	Milk replacers, % whey cream			
	0%	10%	20%	P-value
Digestive organ	Weight expressed as % of body weight			
Reticulorumen	1.82	1.83	1.82	0.61
Omasum	0.47	0.50	0.46	0.57
Abomasum	0.54	0.57	0.58	0.52
Small intestine	2.63a	3.27b	3.37b	0.05
Small intestine length, feet	27.9	31.6	29.8	0.14

The nutritional components (protein and fat) and bioactive properties of procream, and specifically the MFGM, appear to enhance growth and development of calves. Inclusion of 10% to 20% procream can provide the nutrition and health benefits calves need early in life. Healthier and greater gastrointestinal growth is likely to improve feed efficiency and health of animals throughout life.

References

Dewettincka, K., R. Rombauta, N Thienponta, T. T. Lea, K. Messensb, and J. Van Campc. 2008. Nutritional and technological aspects of milk fat globule membrane material. Int. Dairy J. 18:436-457.

Fong, B. Y., C. S. Norris, and A. K. H. MacGibbon. 2006. Protein and lipid composition of bovine milk-fat-globule membrane. Int. Dairy J. 17:275-288.

Fuller, K. L. T. B. Kuhlenschmidt , M. S. Kuhlenschmidt , R. Jiménez-Flores and S. M. Donovan. 2013. Milk fat globule membrane isolated from buttermilk or whey cream and their lipid components inhibit infectivity of rotavirus in vitro. J Dairy Sci. 96:3488-3497.

Kvistgaard, A. S., L. T. Pallesen, C. F. Arias, S. López, T. E. Petersen, C. W. Heegaard, and J. T. Rasmussen. 2004. Inhibitory effects of human and bovine milk constituents on rotavirus infections. J. Dairy Sci. 87:4088-4096.

Laberge, R. J., R. S. Younker, J. Schefers, and N. B. Litherland. 2013a. Replacing 10 and 20 percent of dairy calf milk replacer with whey cream yields similar starter intake, growth, and health performance during the nursery phase. J. Dairy Sci. 96:E-Supplement 1. Abst. 646. P. 656.

Laberge, R. J., J, Schefers, R. S. Younker, and N. B. Litherland. 2013b. Partial substitution of conventional milk replacer with whey cream drives starter intake, gastrointestinal development, and growth of dairy calves. J. Dairy Sci. 96:E-Supplement 1. Abst. 684. P. 646.

Meyer, A. M., B. W. Hess, S. I. Paisley, M. Du, and J. S. Caton. 2014. Small intestinal growth measures are correlated with feed efficiency in market weight cattle, despite minimal effects of maternal nutrition during early to midgestation. J. An. Sci. 92:3855-3867.

Reinhardt, T. A., and J. D. Lippolis. (2006). Bovine milk fat globule membrane proteome. J. Dairy Res. 73:406–416.

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