

CONSULTANT'S DIGEST

Do Reproductive Fat Supplements Deliver?

Calcium soaps of fatty acid products with higher unsaturated fatty acid content are promoted to improve reproduction. They are sold based on the premise that these unsaturated fatty acid supplements will deliver more of these fatty acids (FA) to the small intestine where they will be absorbed. In turn, they will inhibit prostaglandin F2 α , which will help maintain the viability of the embryo, and thus pregnancy. But are these FA delivered to the small intestine without modification? The most recent comprehensive data⁵ to evaluate this question indicate *NO*.

Digestion/metabolism trials were done with lactating cows fitted with rumen and small intestine cannulas for measuring intake, ruminal changes, intestinal absorption and overall digestibility of fatty acids.^{2,3,4,5} There were non-fat control and treatment diets with saturated free fatty acids (Energy Booster 100[®]), a reproductive formulation of calcium soaps containing high levels of unsaturated fatty acids (MEGALAC[®]-R), and a 50:50 blend of Energy Booster 100 and MEGALAC-R. Fat sources provided 2.5 percent fatty acids in TMR diets.

Rumen microbes biohydrogenated large portions of the unsaturated fatty acids in MEGALAC-R to saturated fatty acids (most notably stearic)—what the cow's system naturally prefers. Cows fed MEGALAC-R also experienced intake depression ($P<0.01$) along with decreased milk production, decreased milk fat % and decreased milk lactose %. This rumen biohydrogenation process of unsaturated fatty acids often produces intermediates, most notably *trans*-10 *cis*-12 CLA (conjugated linoleic acid), which are potent milk fat depressants.¹ Furthermore, this rumen biohydrogenation occurred even though mean rumen pH was 6.0,⁵ dispelling the belief that calcium soaps of FA do not dissociate and undergo biohydrogenation of their FA at rumen pH of 6.0 or above.

As expected, as the level of MEGALAC-R in the diet increased, intake of dietary FA decreased linearly ($P<0.001$) for saturated C16:0 and C18:0 and for unsaturated C18:1-*trans*, and increased linearly ($P<0.001$ or .02) for unsaturated C18:1-*cis*, C18:2 and C 18:3. However, due to ruminal biohydrogenation of dietary unsaturated FA, duodenal flow was considerably altered. (See table)

Diets with more unsaturated C18 FA were heavily biohydrogenated to C18:0. This resulted in duodenal flow of C18:0 (stearic) increasing nearly nine times the intake levels for cows fed MEGALAC-R compared to just over twice for cows fed Energy Booster 100. This factor accounted for the substantial decreases in the duodenal flow of all unsaturated C18 FA except C18:1-*trans*. Biohydrogenation of C18:1-*trans* is considered the rate-limiting step in ruminal biohydrogenation, allowing C18:1-*trans* to accumulate in the rumen. The duodenal deliverance of C18:2 was the same among diets, even though there were higher ($P<0.02$) intakes with increasing dietary levels of MEGALAC-R.

The most unsaturated FA in the diets, C18:3, decreased in duodenal flow ($P<0.04$) with increasing dietary levels of MEGALAC-R.

Thus, the two polyunsaturated FA either did not increase or actually decreased in duodenal flow, despite their higher levels from inclusion of MEGALAC-R in diets.



	Diet containing Energy Booster 100		Diet containing Energy Booster 100: MEGALAC-R		Diet containing MEGALAC-R	
	Intake, g/day	Duodenal flow, g/day	Intake, g/day	Duodenal flow, g/day	Intake, g/day	Duodenal flow, g/day
16:0	485	442	458	426	433	349
18:0	380	882	208	683	54	470
18:1-<i>trans</i>	12	167	6.9	276	2.7	264
18:1-<i>cis</i>	266	84	323	101	361	103
18:2	668	102	705	99	710	97
18:3	40	7.8	44	7.6	47	6.6

Fat Fast Facts

- MEGALAC-R increased dietary intake levels of polyunsaturated fatty acids
- But, ruminal biohydrogenation converted these more unsaturated fatty acids to more saturated fatty acids.
- *Thus*, duodenal delivery of polyunsaturated fatty acids was either the same or reduced.
- *The premise* that more unsaturated fatty acids can be delivered for reproductive benefit in the form of calcium soaps of fatty acids (MEGALAC-R) to result in more duodenal availability for absorption has been shown to be invalid.

¹Griinari et al., 1998. J. Dairy Sci. 81:1251-1261. ²Harvatine et al., 2006a. J. Dairy Sci. 89:1081-1091. ³Harvatine et al., 2006b. J. Dairy Sci. 89:1092-1103. ⁴Harvatine, et al., 2006c. J. Dairy Sci. 89:1104-1112. ⁵Harvatine, et al., 2006d. J. Nutr. 136: 677-685. MEGALAC is a registered trademark of Volac International Limited and is licensed to Church & Dwight Co., Inc.