

## **Improvement of the milk fat by supplementation of calcium salts of fatty acids with unique fatty acids profile**

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The form of the lipid supplement—triglyceride or free FA (fatty acids), calcium salt, or prilled fat its degree of saturation, and its FA profile greatly influences the cows' productive response. The two most popular rumen-inert fat supplements are calcium salts of fatty acid (**CSFA**) and saturated-free FA (FFA). Most of the studies published on the effects of fatty acids profile on digestibility and cow performance involved a blend of fat supplements in different forms. Therefore, a comparative study examining the effects of a similar fatty acids profile of the fat supplement but in different forms, or a similar form but with a different fatty acids profile is required to distinguish between the effect of form and the fatty acids profile of the supplemental fats. In the first study, we examine the effect of fat supplements that differ in their form or FA profile on nutrient digestibility and the cows' performance. Forty-two mid-lactation cows were fed rations that contained (on a DM basis): 1) **CS45:35** – 2.4% of calcium salts of fatty acids (CSFA) consisting of 45% palmitic acid (**PA**) and 35% oleic acid (**OA**); 2) **CS80:10** – 2.4% of CSFA consisted of 80% PA and 10% OA; 3) **FF80:10** - 2.0% of free FA consisted of 80% PA and 10% OA. Compared with CS45:35, CS80:10 tended to have lower milk yields, but higher fat percentage, without differences in all other production parameters. The fat percentage was highest in the FF80:10 (4.02%), intermediate in the CS80:10 (3.89%), and lowest in the CS45:35 cows (3.75%). Compared with CS80:10, FF80:10 tended to increase milk yields and fat percentage, and increased 4% fat corrected milk (FCM) and energy-corrected milk (**ECM**) yields. Treatment had no effect on dry matter intake, and the 4% FCM/DMI and ECM/DMI ratios were higher in the FF80:10 as compared to the CS80:10 group. Compared with CS45:35, the apparent total tract digestibilities of neutral detergent fiber (NDF) and acid detergent fiber (ADF) were higher in CS80:10, whereas digestibilities of dry matter, organic matter, protein, NDF and ADF were higher in the CS80:10 compared with the FF80:10 cows. Compared with CS80:10, the apparent digestibility of crude fat was ~10 percentage units lower in the FF80:10, and similarly, the digestibilities of 16-carbon and 18-carbon FAs were lower in the FF80:10 than in the CS80:10 cows. From the first study we concluded that the form more than the FA profile of fat supplements, influences digestibility, in which CSFA supplements were more digestible than the free fatty acids, regardless of the FA profile. However, it appears that energy partitioning towards production was higher in the FF80:10 cows, although the digestibility of nutrients was lower than in the CSFA product with a similar FA profile. In the second study, we examined the effects of supplemental fats in the form of **CSFA** in different ratios between PA and OA on nutrient digestibility and cow performance. Cows were fed rations that

contained 2.2% CSFA (on a dry matter basis) consisting of 1) **CS45:35** – 45% PA and 35% OA, 2) **CS60:30** – 60% PA and 30% OA, and 3) **CS70:20** - 70% PA and 20% OA. Increasing the PA-to-OA ratio decreased the milk yields and ECM yields, but milk fat content was increased (3.55, 3.94, and 3.87% in the CS45:35, CS60:30, and CS70:20 groups, respectively); however, the highest yields were observed in the CS60:30 cows. Dry matter intake (DMI) was highest in the CS60:30 group and lowest in the CS70:20 group. The milk-to-DMI ratio was decreased, and the ratio of ECM-to-DMI tended to decrease when the PA-to-OA ratio increased. Increasing the PA-to-OA ratio decreased the digestibilities of dry matter, organic matter, protein, and neutral detergent fiber (NDF); however, the total FA and FA subgroups were similar among groups. Apparently, the form of the fat supplements is more dominant in influencing FA digestibility, and under the current research conditions, the CS60:30 cows had the highest performance in terms of fat content and yields and nutrients digestibility, whereas the CS70:20 cows' had the lowest performance. Furthermore, the different effects of the PA-to-OA ratio in supplemental fat indicate that in the future, the FA profile of the provided supplement will be determined according to the defined goal: milk or milk fat.