FAT FEEDING FACTS 8

Should We Feed Palmitic, Stearic, or both in Fat Supplements?

Palmitic fatty acid (FA) is present in many palm FA by-products, as its name implies. For instance, palm FA distillate is often used in calcium salts of long chain FA. In a typical non-fat supplemented 60% forage diet (alfalfa hay/silage and corn silage in J. Dairy Sci. 74:3025-3034, 1991), out of about one lb (454 g) of total FA intake, palmitic was 71 g but stearic was only 12 g. That is because most plant sources have great quantities of triglycerides, comprised primarily of linoleic and linolenic FA, while stearic is low in most cow diets because it is an animal source produced by ruminal biohydrogenation (Fat Feeding Facts 3) from linoleic and linolenic FAs. In the table below, note that there was only 12 g intake of stearic, but over 15 times more flowing out of the rumen. The total intake of linoleic and linolenic was 209 g, and only 47 g total remained to flow out of the rumen after ruminal biohydrogenation to stearic.

FATTY ACID INTAKE, G/DAY	INTAKE	RUMEN OUTFLOW
Palmitic C16:0	**71**	**83**
Stearic C18:0	**12**	**186**
Oleic C18:1	**79**	**60**
Linoleic C18:2	**171**	**45**
Linolenic C18:3	**38**	**2**
Total	**431**	**402**

Of the fats leaving the rumen, 85 to 90% are free FAs comprised of about 2/3 stearic and1/3 palmitic with the balance of 10 to 15% being phospholipids as microbial cell walls. FAs in milk are about 65% saturated (40% palmitic, stearic, myristic) and 35% unsaturated (2/3 oleic, linoleic, linolenic).

This leads to the title of this article. With the advent of high palmitic FA supplements (about 85% palmitic), scientific trials and field results have illuminated several characteristics of palmitic and stearic FAs. High palmitic supplementation tends to increase milk fat % by 0.1 to 0.3%, but not consistently. And it often results in decreased dry matter intake (DMI). Here is a summation (J. Dairy Sci. 97:4661-4674, 2014) of key characteristics of palmitic and stearic FA:

Palmitic

- Very poorly absorbed into adipose (fat) tissues
- Highest level of FA in blood NEFAs (non-esterified FA)
- Can accumulate in liver and impair glucose synthesis—which is necessary for milk lactose and milk volume production
- Can be oxidized to produce energy for the cow, but liver accumulation and oxidation can decrease DMI
- Helps increase milk fat % but this is partially offset by decreased synthesis of shorter chain FA than palmitic in milk

Stearic

- Located throughout many tissues and oxidized to provide for the cow's many energy needs
- Does not accumulate in the liver, nor contribute to DMI decrease
- The most prevalent unsaturated FA in cow tissue and in milk is oleic (C18:1) which the cow creates by converting from stearic (C18:0)
- Tends to increase milk fat%, but does not decrease shorter chain FA
- Facilitating glucose synthesis aids in milk volume increase and possibly milk protein synthesis too

Science continues to evolve with further research that can modify or increase our understanding of how the cow utilizes palmitic and stearic FA. But together, these two FA appear to complement each other and overall responses.