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# THE NUTRITIONAL CONSULTANT'S DIGEST

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## What Should the Composition Of Your Inert Fat Supplement Be?

Recent research results from several short term studies feeding an inert FA supplement containing >80% palmitic acid (16:0) have caused a great deal of interest in the composition of inert fatty acid (FA) supplements. Some of these studies have shown increases in milk fat % and milk fat yield, while others have shown no significant response or significantly reduced milk fat % and yield. Half of the studies have shown significant increases in milk yield and the other half have not. Three of the studies have shown significant reductions in dry matter intake (DMI). The results of these trials are illustrated in Table 1.

Table 1. The effects of high palmitic acid supplementation on milk yield, components and transfer efficiency.

| Study | Treatment | Amount of C16:0 Fed g/d | DMI Lb./d | Milk fat % | Milk Yield Lb./d | Transfer Efficiency % |
|---|---|---|---|---|---|---|
| Warntjes, et al. | Control | 0 | 57.6 | 3.75a | 80.7a | |
| | High16:0 | 384 | 58.1 | 3.6b | 83.6b | -2.08% |
| Rico & Harvatine | Control | 0 | 55.7a | 3.86 | 63.4 | |
| | High16:0 | 394 | 50.6b | 3.92 | 63.8 | 6.35% |
| Rico & Harvatine | Control | 0 | 62.3a | 3.14 | 91.3 | |
| | High16:0 | 449 | 58.1b | 3.22 | 92.4 | 10.91% |
| Lock et al | Control | 0 | 54.3a | 3.88a | 70.4 | |
| | High16:0 | 361 | 51.3b | 4.16b | 70.4 | 25.76% |
| Piantino et al | Control | 0 | 61.2 | 3.29a | 98.8a | |
| | High16:0 | 545 | 61.2 | 3.40b | 101.2b | 14.68% |
| Mosley et al | Control | 0 | 51.3 | 3.44a | 68.0a | |
| | High16:0 | 768 | 54.3 | 4.06b | 75.2b | 39.32% |
| Average | Control | 0 | 57.1 | 3.56 | 78.8 | |
| | High16:0 | 484 | 55.6 | 3.73 | 81.1 | 18.65% |

As you can see, the results of these trials are variable in response, whether it is DMI, milk yield, or milk fat %. These trials were designed with experimental periods from 14-35 days. The longest trial periods of 35 days, Warntjes et al 2008, observed a significant reduction in milk fat %. The C16:0 transfer from diet to milk fat is less than 20% — where did the rest of it go? From the landmark studies of Steele 1969, Noble et al., 1969, and the study of Enjalbert et al., 2000, the addition of high quantities of either C16:0 or stearic acid (C18:0) caused significant changes in milk fat % and yield, and milk FA composition. These results are summarized in Table 2.

Table 2. The effects of feeding or infusing high quantities of either C16:0 or C18:0 on milk fatty acid composition. Adapted from Steele, Noble et al., 1969, and Enjalbert et al., 2000.

| Treatment | C16:0 | C18:0 |
|---|---|---|
| Amount Fed or Infused g/d | 505 | 491 |
| Fatty Acid wt% of Milk Fat | | |
| C4:0-C14:0 | 17.3 | 20.9 |
| C16:0 | 52.2 | 24.8 |
| C18:0 | 3.4 | 14.6 |
| C18:1 | 14.8 | 26.2 |
| C18:2 & 3 | 1.7 | 1.8 |

It is clear that C16:0 and C18:0 when added alone to the diet in high quantity cause major changes in FA composition of milk fat. C16:0 and C18:0 cause a reductions in C4:0-C14:0 FA proportions in milk fat when compared to the control. C16:0 additions reduce C18:0, C18:1, and C18:2+C18:3 proportions, while it increases C16:0 in milk. C18:0 reduces C16:0 proportions while it increase those of C18:0, C18:1, and C18:2+3 in milk. It appears that feeding or infusing either C16:0 or C18:0 alone in high quantities alters milk FA composition significantly. Trials where a more balanced approach to feeding both C16:0 and C18:0 have shown quite different results. Drackley et al., 1992, and Relling and Reynolds, 2007, fed or infused on the average 540m g/d of Energy Booster 100, an inert fat containing approximately 40% C18:0, 39% C16:0, and 12% C18:1 and improved milk yield, milk fat%, and milk fat yield without significantly changing milk FA composition. Kadegowda et al., 2008, infused 400 g/day of milk fat extracted from the milk of cows containing 26.7% C16:0, 11.5% C18:0, and 30.2 % C18:1. into the abomasum and observed similar responses to feeding or in fusing Energy Booster. These results are illustrated in Table 3.

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## What Should The Composition Of Your Inert Fat Supplement Be? (continued)

Table 3. The effects of either feeding or abomasally infusing Energy Booster 100, or abomasally infusing milk fat in lactating dairy cows on milk yield, components, and milk FA composition.

| Study | Drackley et al and Relling and Reynolds | | Kadegowda et al 2008 | |
|---|---|---|---|---|
| Item | Control | Energy Booster 100 | Control | Milk Fat |
| Fat added g/d | 0 | 540 | 0 | 400 |
| DMI lb./d | 53.1 | 53.0 | 52.1 | 53.2 |
| Milk Yield lb/d | 75.8 | 78.0 | 70.0 | 74.1 |
| Milk Fat % | 3.24 | 3.58 | 3.74 | 4.26 |
| Milk Fat g/d | 1116 | 1269 | 1190 | 1260 |
| Milk FA wt % | | | | |
| C4:0-C14:0 | 25.1 | 24.5 | 27.2 | 25.5 |
| C16:0 | 29.2 | 30.5 | 35.1 | 33.1 |
| C18:0 | 7.6 | 8.8 | 8.1 | 7.3 |
| C18:1 | 21.1 | 24.2 | 16.5 | 18.1 |
| C18:2+3 | 3.6 | 2.95 | 3.4 | 3.6 |

The conclusion to these studies is a clear one. Lactating cows improve their milk yield, milk fat %, and milk fat yield with Energy Booster 100, without affecting milk FA proportions. Lactating cows respond similarly to infused milk fat FA. These studies along with the studies feeding high C16:0 levels indicate that the proper ratio of C16:0 to C18:0+C18:1 in your inert fatty acid supplement should be 0.65-0.75 to 1. The composition of the inert FA supplement should resemble the average milk FA of cows' milk which has a ratio of 0.79 to 1 C16:0 to C18:0 +C18:1. The average milk fatty acid composition from 50 processors all over the U. S. is in Table 4 (Palmquist et al. 1993).

Table 4. Average milk fatty acid composition of cows' milk from 50 different U. S. processing plants.

| Fatty acid | C4:0 | C6:0 | C8:0 | C10:0 | C12:0 | C14:0 |
|---|---|---|---|---|---|---|
| Wt % | 3.3 | 2.3 | 1.2 | 2.8 | 3.4 | 11.4 |
| Fatty acid | C14:1 | C16:0 | C16:1 | C18:0 | C18:1 | C18:3 |
| Wt % | 2.6 | 29.5 | 3.4 | 9.8 | 27.4 | 2.8 |

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