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SUPPLEMENTAL FATTY ACIDS: MUCH MORE THAN JUST FAT AND ENERGY




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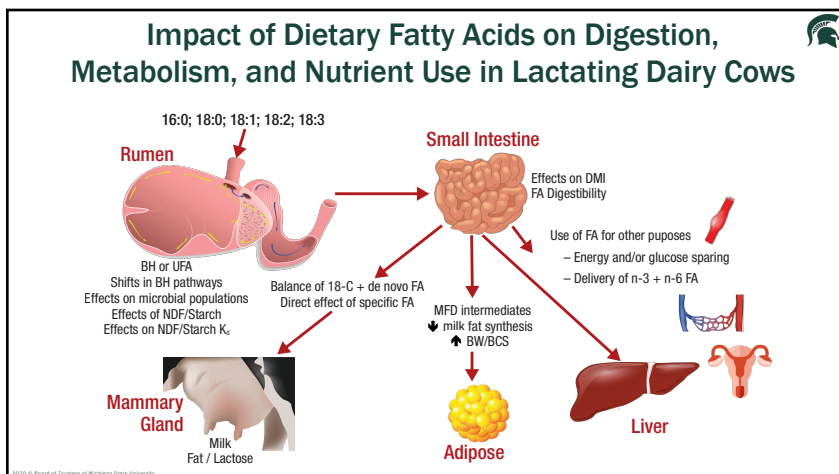
Balchem
Real Science Lecture Series
October 6, 2020

Energy Supply is an Important Reason Why We Feed Fatty Acids (Fats)

Cows producing 60kg milk/d
1.8 Mcal NE_L/kg of dry matter (DM)

Forages	Concentrates	Fats
		
Cool season grass: 1.5 Mcal NE _L /kg DM	Corn grain: 2.0 Mcal NE _L /kg DM	Vegetable oil: 4.4 Mcal NE _L /kg DM

Caloric vs. Non-Caloric Effects



Where Is Supplemental Fat Feeding Today?

A BAG OF FAT IS NOT JUST A BAG OF FAT!

ITS COMPLICATED!

FA profile of a fat supplement is the first factor in determining the response to it

How's a Nutritionist to Decide on All of the Different By-Pass Products?

Will discuss and answer (hopefully) questions related to:

- Summarize responses to the major categories of fat supplements available
- Challenge concepts on effects of FA feeding on DMI, NDFd, fresh cows
- Highlight importance of FAd to effectiveness of FA supplementation
- Underline importance of oleic acid on FAd and its potential to impact energy partitioning
- Present recent data on different blends of FA and impact across different stages of lactation and production level

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3 Major Categories of FA Supplements Available

Fatty Acid, g/100 g	Ca-salt PFAD	Saturated free FA Supplements	
		Mix	C16:0-enriched
C14:0	2.0	2.7	1.6
C16:0	51.0	32.8	89.7
C18:0	4.0	51.4	1.0
C18:1 (n-9)	36.0	5.8	5.9
C18:2 (n-6)	7.0	0.8	1.3

- None of these FA supplements were designed with the cow in mind!
- All simply took the 'best' by-product for the respective manufacturing technology

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- C16:0, C18:0, and C18:1 are important for dairy cow metabolism
- Is there an "ideal" ratio among C16:0, C18:0, and C18:1 to optimize their utilization
- Interactions with other dietary and animal factors

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J. Dairy Sci. 95:3225–3247
http://dx.doi.org/10.3168/jds.2011-4895
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Effect of fat additions to diets of dairy cattle on milk production and components: A meta-analysis and meta-regression

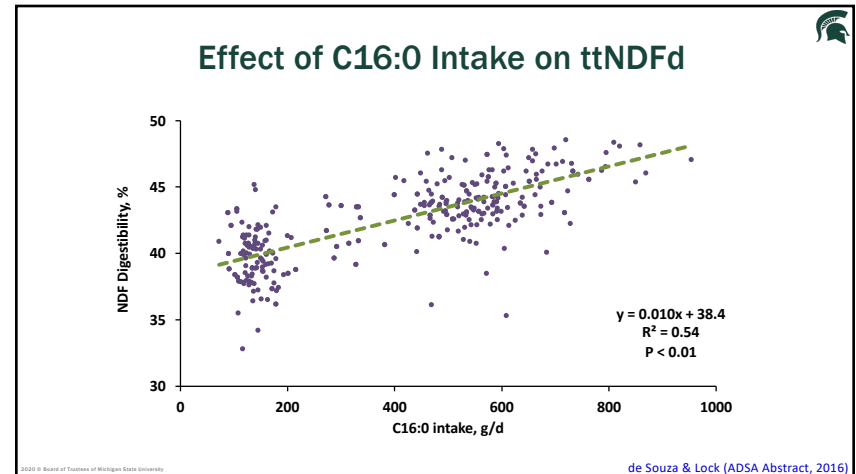
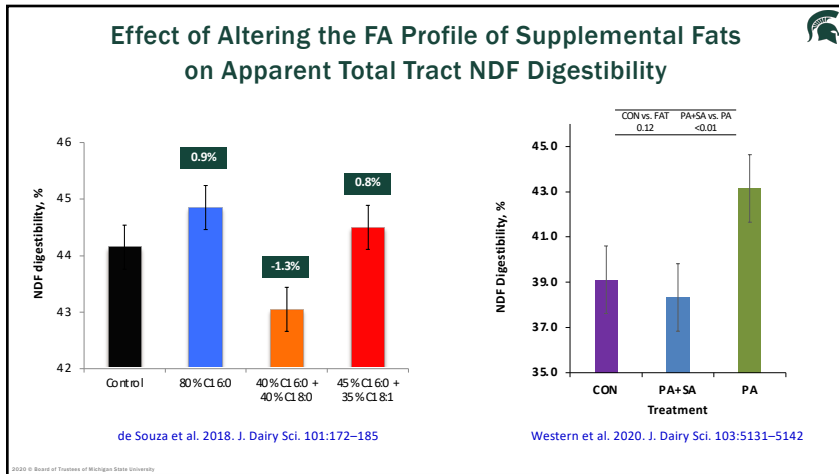
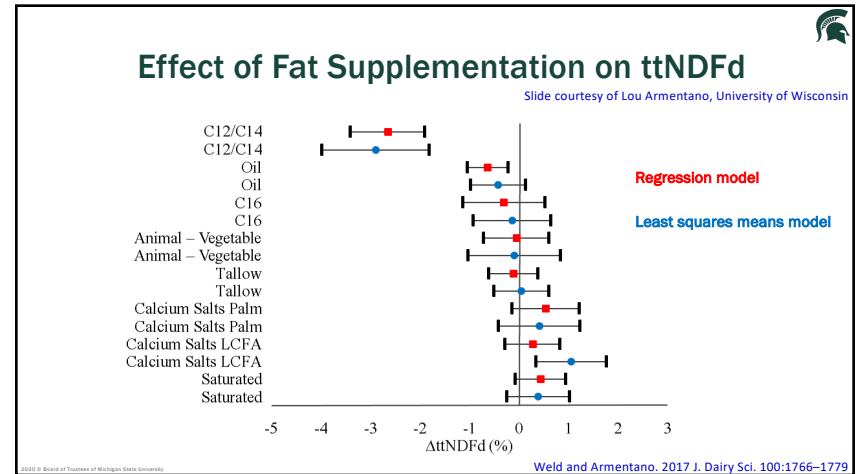
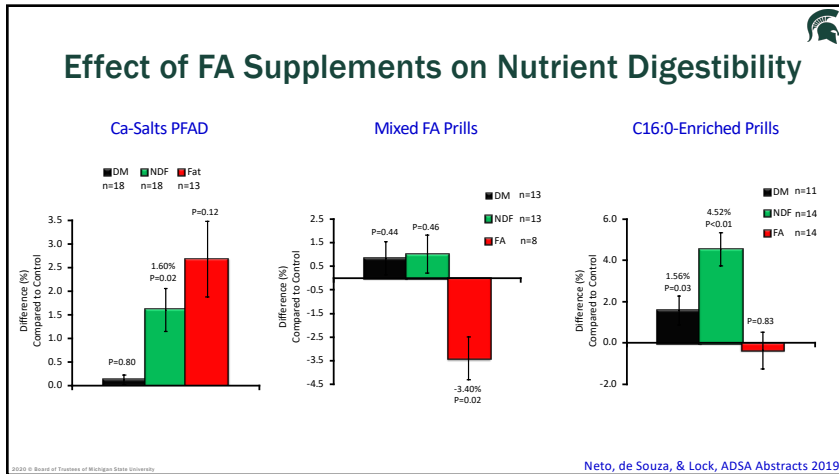
A. R. Rabiee,* K. Breinhild,* W. Scott,* H. M. Golder,* E. Block,† and I. J. Lean¹
¹SBSolibus, P.O. Box 660, Camden 2670, New South Wales, Australia
[†]Church and Dwight Co. Inc., 469 North Harrison Street, Princeton, NJ 08543

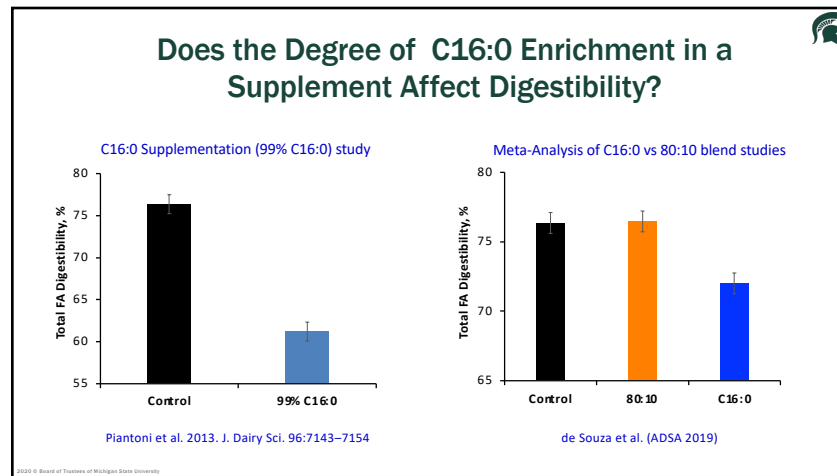
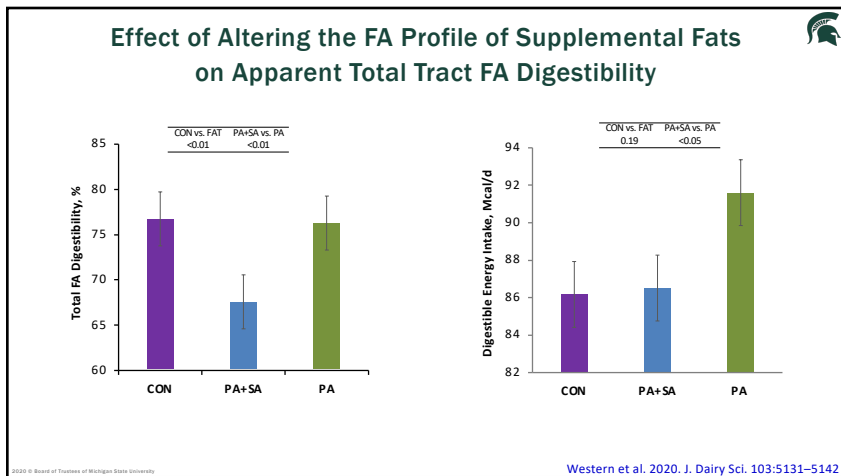
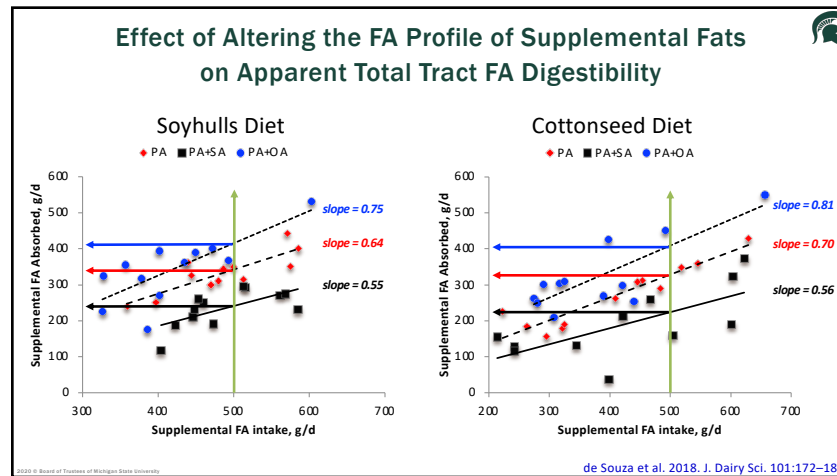
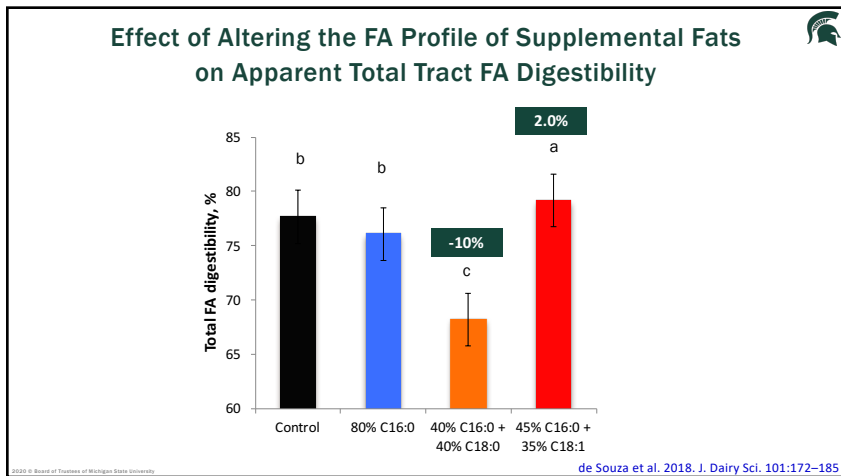
•Supplementing fat in general conclusions:

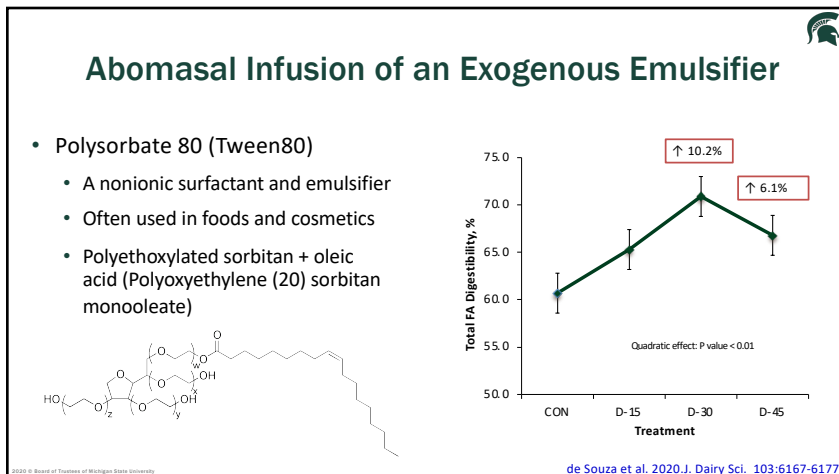
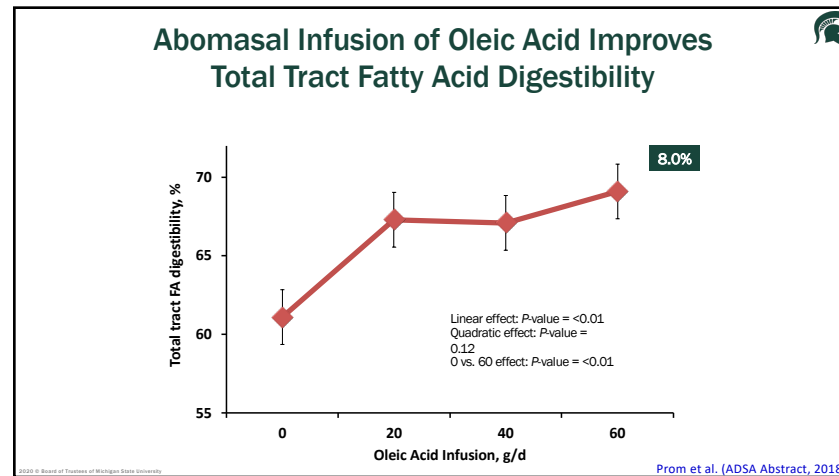
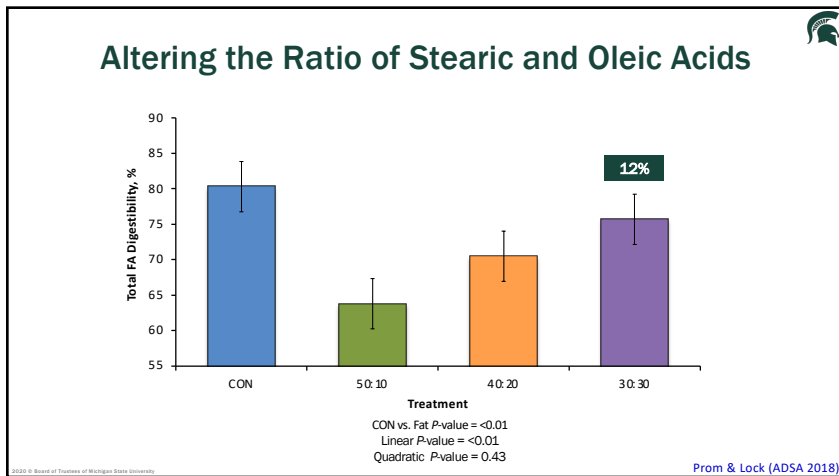
- Reduced DMI
- Increased milk volume
- Reduced milk fat protein and fat percentages
- Increased milk fat yield and did not change milk protein yield
- Therefore increased efficiency

• Different fat sources had markedly different effects on production performance

Rabiee et al. 2012. J Dairy Sci. 95:3225–3247



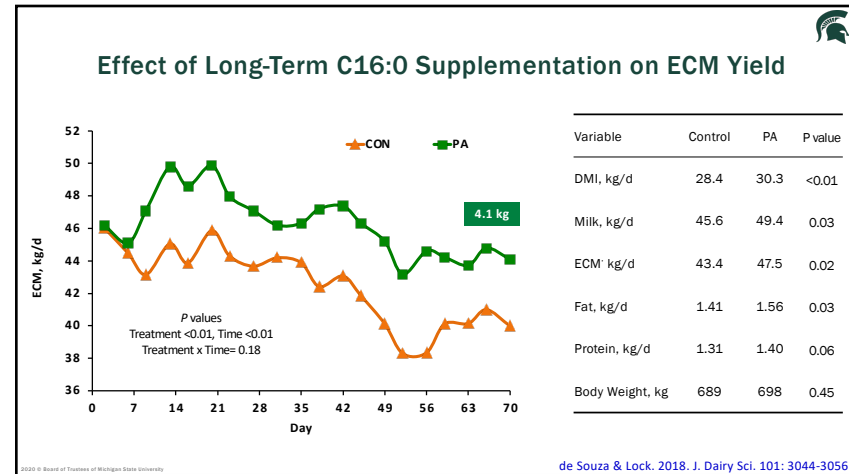
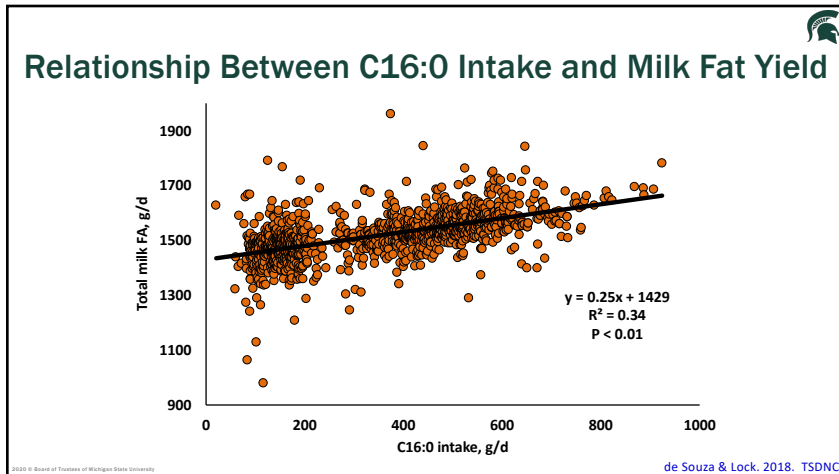
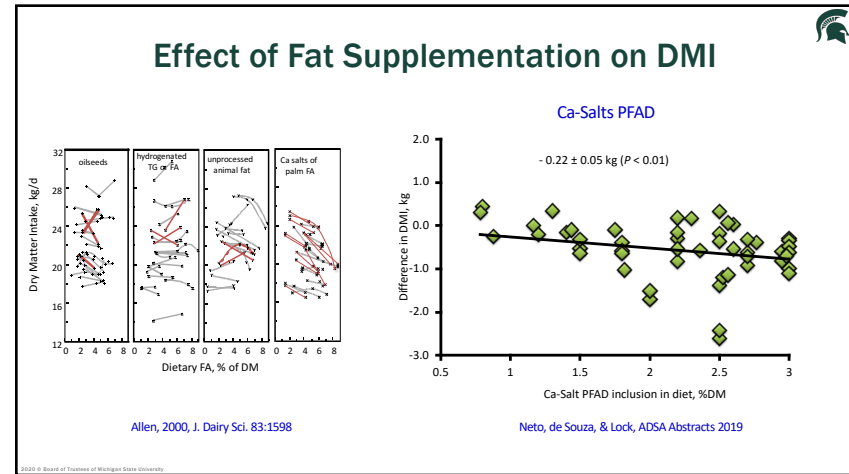
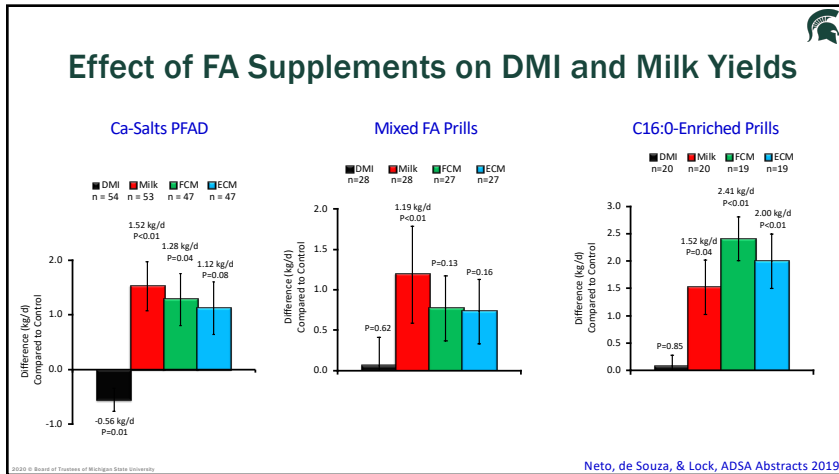


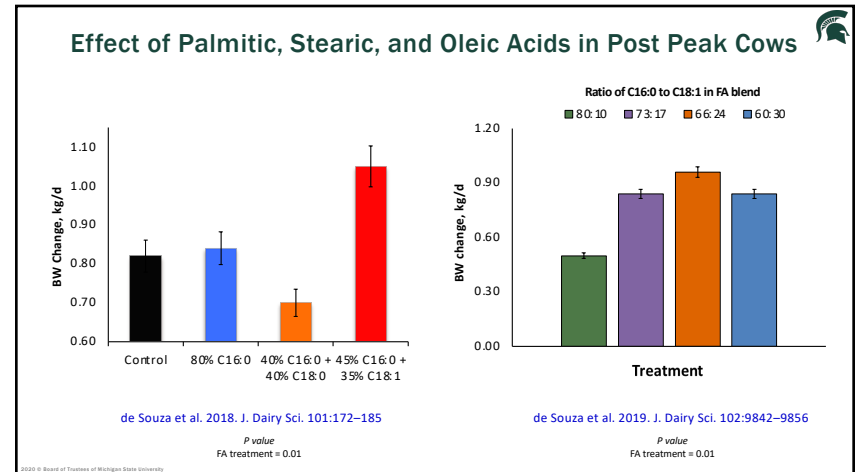
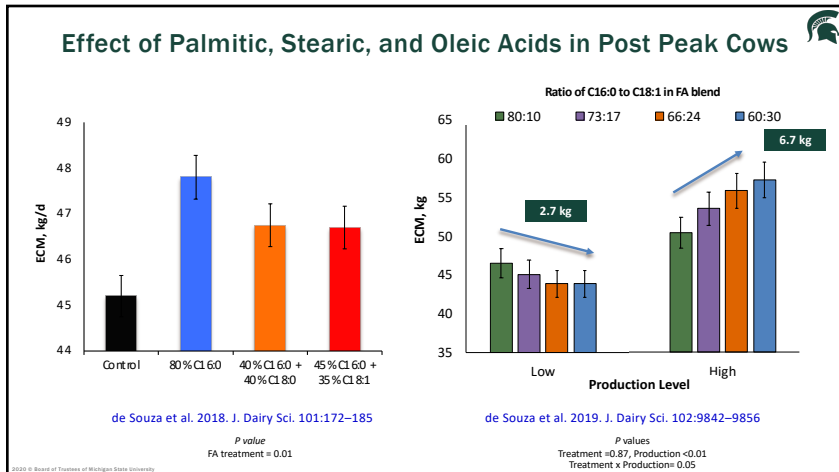
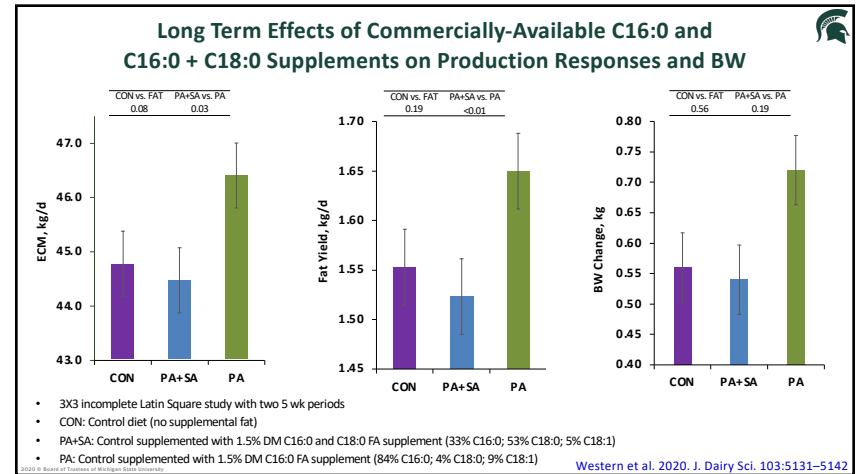
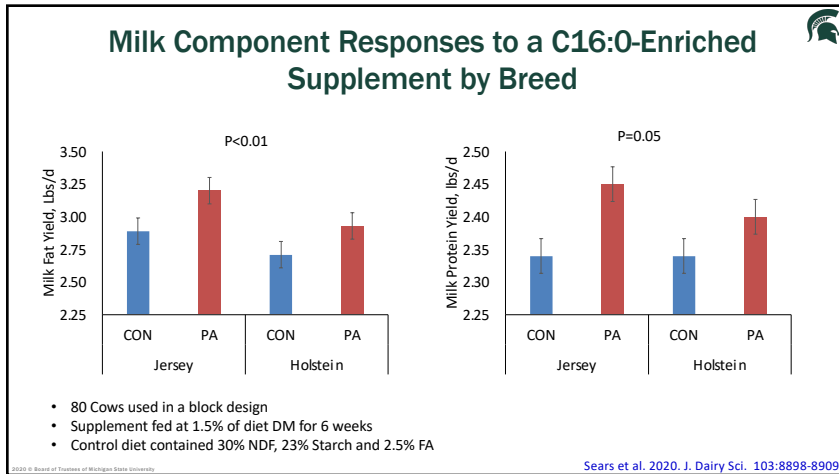


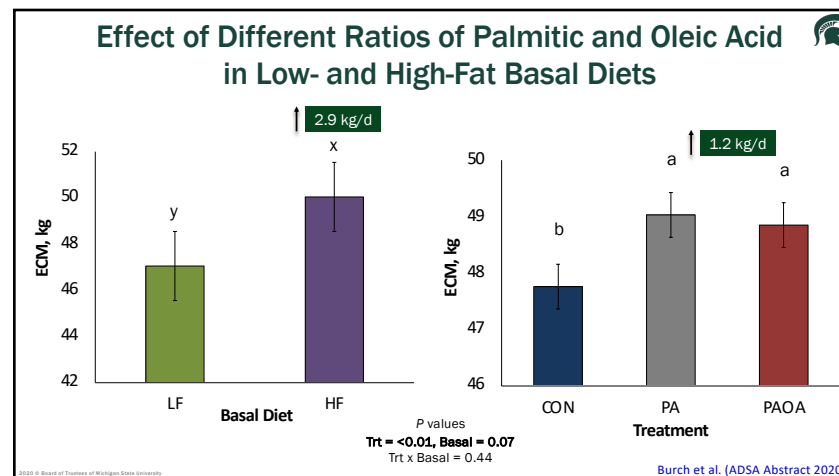
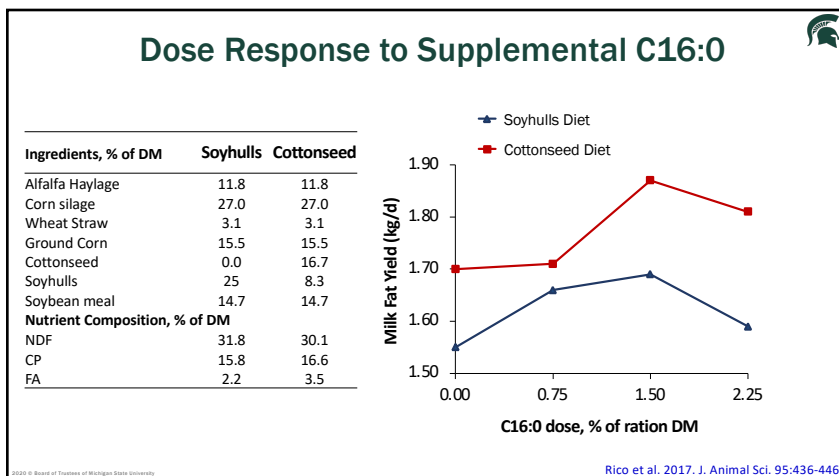
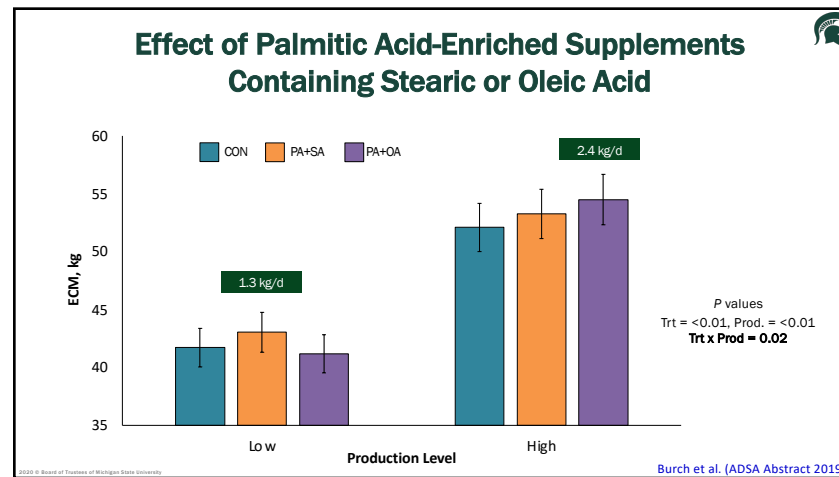
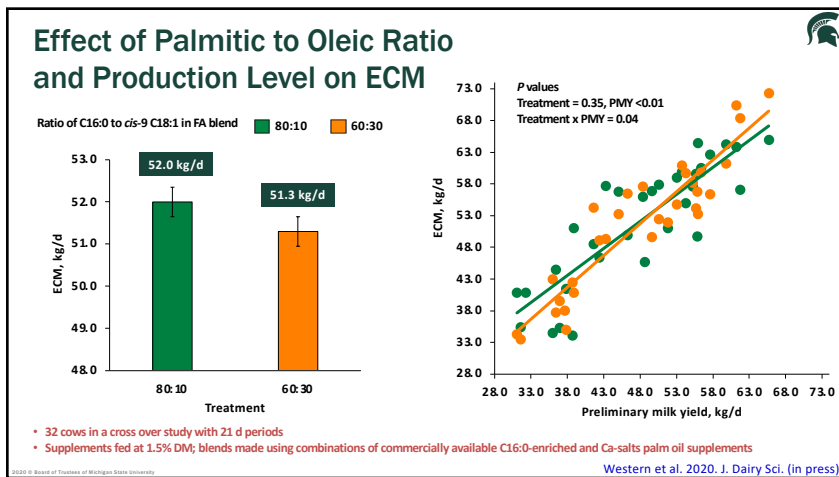
What Limits/Impacts FA Digestibility?

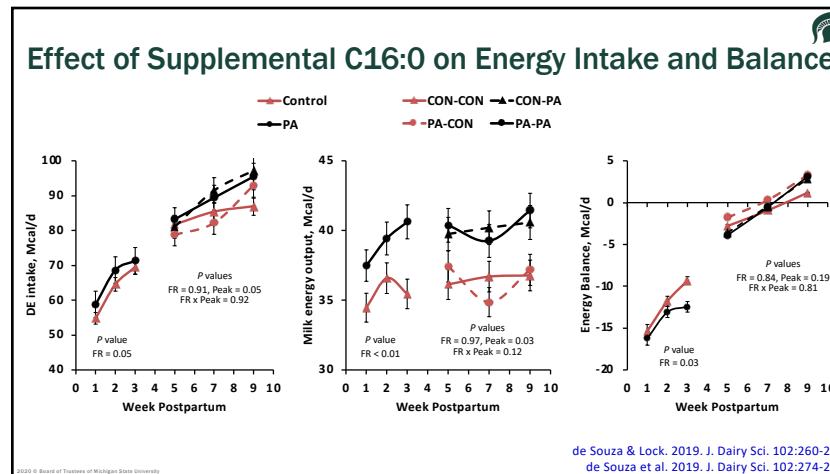
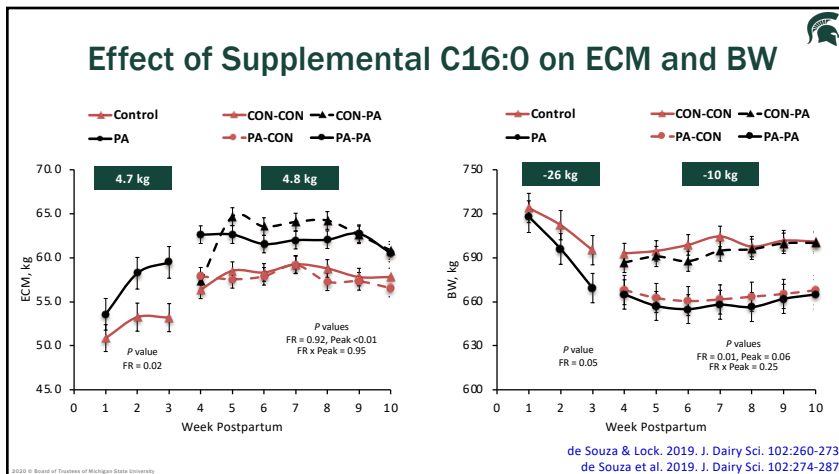
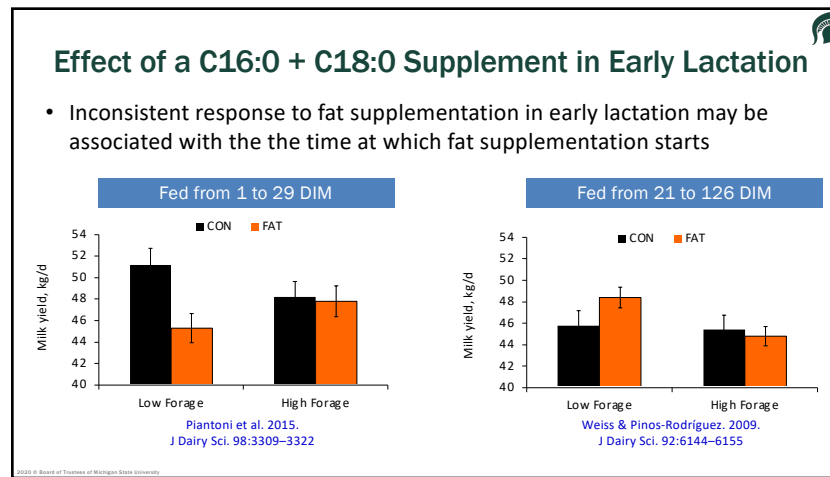
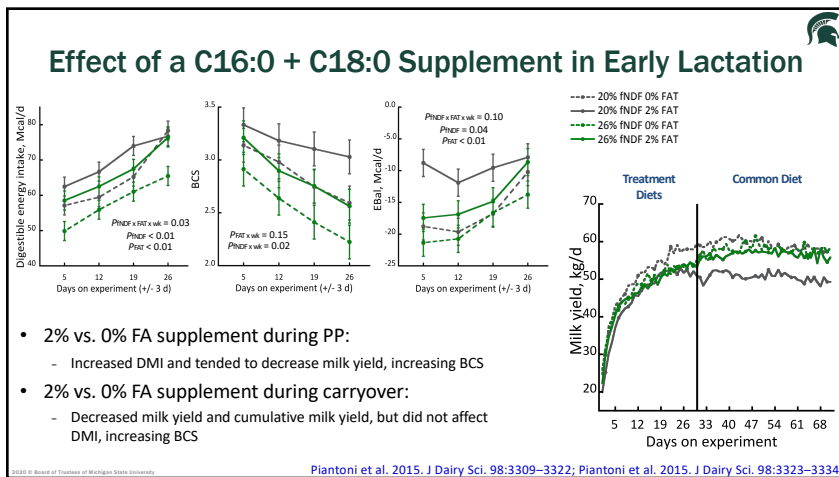
- Profile of FA reaching the duodenum
- Emulsification capacity
 - Total FA flow to the duodenum
 - Degree of esterification/physical form
- Ability of ruminants to absorb SFA much higher than that of non-ruminants
 - In most feeding situations C18:0 is the predominant FA available for absorption
 - Greatest challenge will be to improve C18:0 absorption and/or limit its effects on the absorption of other FA

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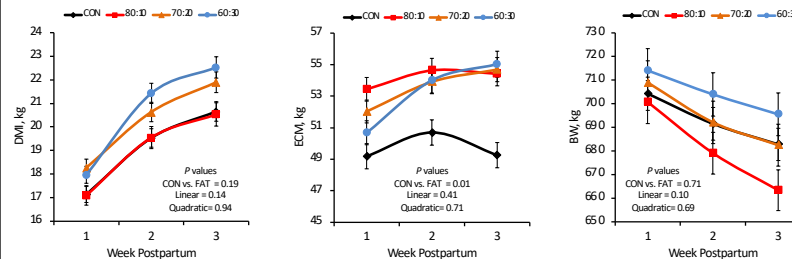


Effect of Altering the Palmitic to Oleic Acid Ratio of Supplemental Fats to Fresh Cows

- 56 multiparous cows in a randomized block design
 - Block design assigned by parity, 305ME, and BCS
 - 4 treatments fed from 1-24 DIM
 - Con = Non-FA supplemented diet
 - 80:10 = 80% C16:0 + 10% C18:1
 - 70:20 = 70% C16:0 + 20% C18:1
 - 60:30 = 60% C16:0 + 30% C18:1
- FA supplemented at 1.5% DM of diet
- FA supplement blends utilized a C16:0-enriched prill [83% C16:0, 11% *cis*-9 C18:1] and a Ca-salt of palm FA [46% C16:0, 39% C18:1]
 - Common diet for carryover period from 25-60 DIM
 - No FA supplemented in feed

de Souza, Prom, & Lock (ADSA 2018)

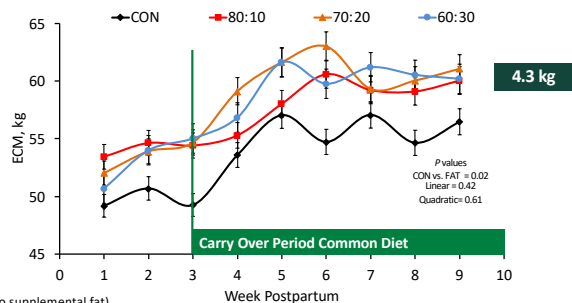
Effect of Altering the Palmitic to Oleic Acid Ratio of Supplemental Fats to Fresh Cows



- CON: Control diet (no supplemental fat)
- FA supplement blends fed at 1.5% DM
- Supplemental fat blends fed from calving for first 3 wk of lactation

de Souza, Prom, & Lock (ADSA 2018)

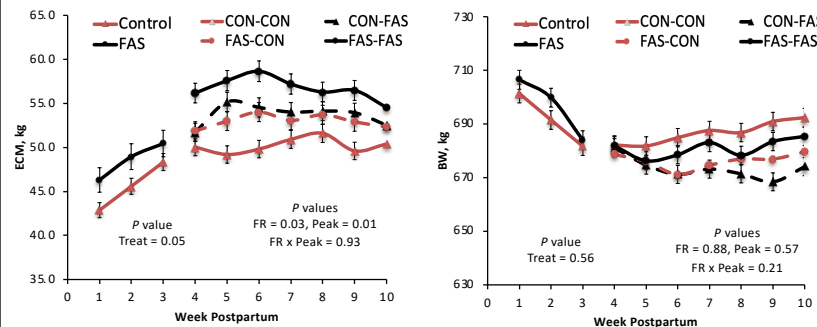
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Effect of timing of a calcium salt supplement containing palmitic and oleic acids on production responses of early lactation dairy cows



Pineda, de Souza, & Lock (ADSA 2020)

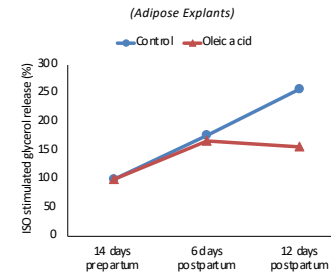
Abomasal Infusion of Oleic Acid in Fresh Cows

- Oleic acid (60 g/d) abomasally infused 4x/d
- Infusions from 1 to 15 DIM
- Adipose tissue (flank) sampled d -14, 6, and 12
- Glucose tolerance test d 15

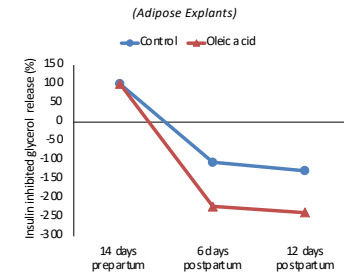


Abomasal Infusion of Oleic Acid in Fresh Cows

Lipolytic Response



Insulin Sensitivity

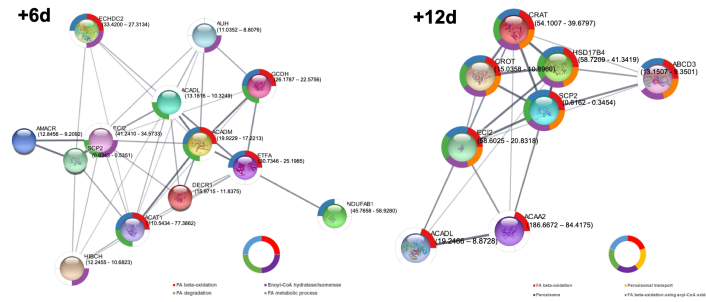


- Results suggest that oleic acid supplementation immediately postpartum may reduce lipolytic responses and improves insulin sensitivity of AT in early lactation dairy cows

Contreras & Lock Labs, unpublished

Abomasal Infusion of Oleic Acid in Fresh Cows

OA supplementation decreased expression of genes involved in FA beta-oxidation



Caloric vs. Non-Caloric Effects of Fatty Acids

- Effect of specific fatty acids:
 - Yield of milk and milk components
 - Maintenance of body condition
 - Nutrient digestion
 - Nutrient partitioning
 - Reproduction
 - Health



Questions to Ask?

- FA profile of the product? ➤ These will determine impact on nutrient digestibility, production performance, and nutrient partitioning
- Total FA content of product?
- What form are the FA in?
- What are my goals for feeding it?
- Which FA do I need to meet these goals?
- Economics of the marginal return
- Consistency/quality of product
- Supporting data

Acknowledgements

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