



# Feeding Blends of Fatty Acids

UPDATE ON PALMITIC  
AND OLEIC ACIDS



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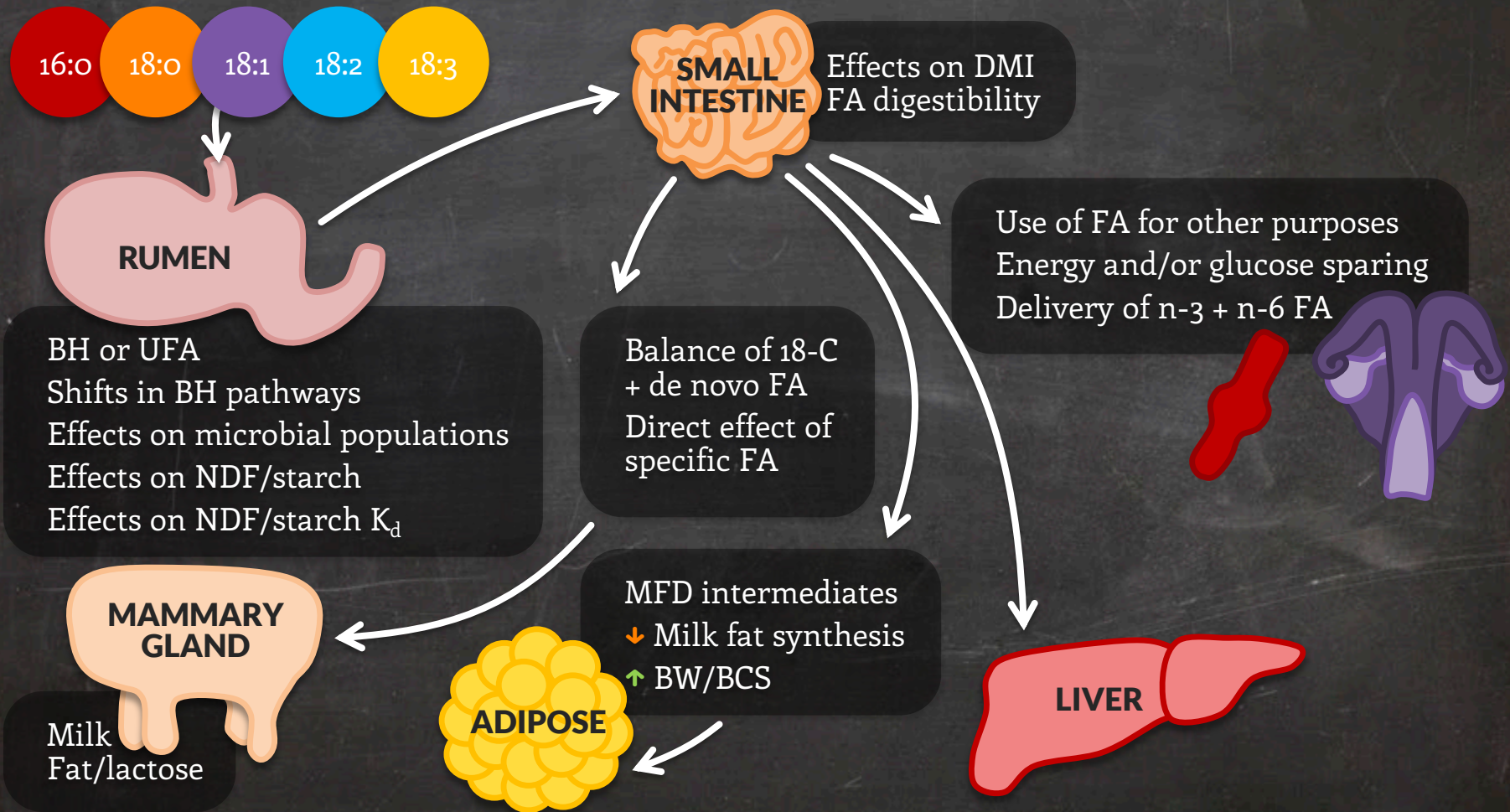
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# Feeding Blends of Fatty Acids: Palmitic & Oleic

## Impact of Dietary Fatty Acids on Digestion, Metabolism, & Nutrient Use in Lactating Dairy Cows

Dr. Adam Lock, Michigan State University



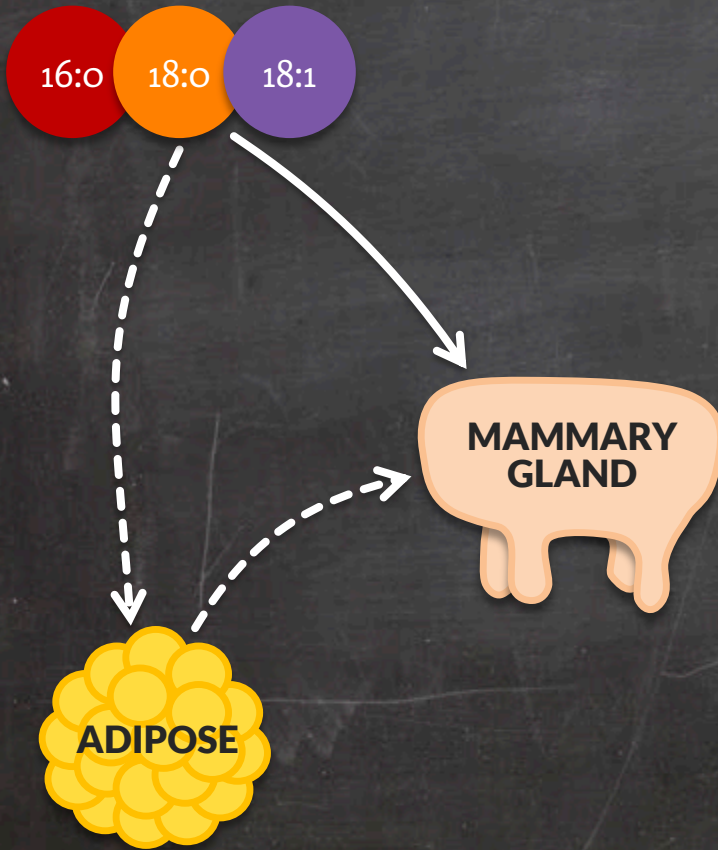




# Feeding Blends of Fatty Acids: Palmitic & Oleic

## Recent Focus on Palmitic, Stearic, and Oleic Acids

Dr. Adam Lock, Michigan State University

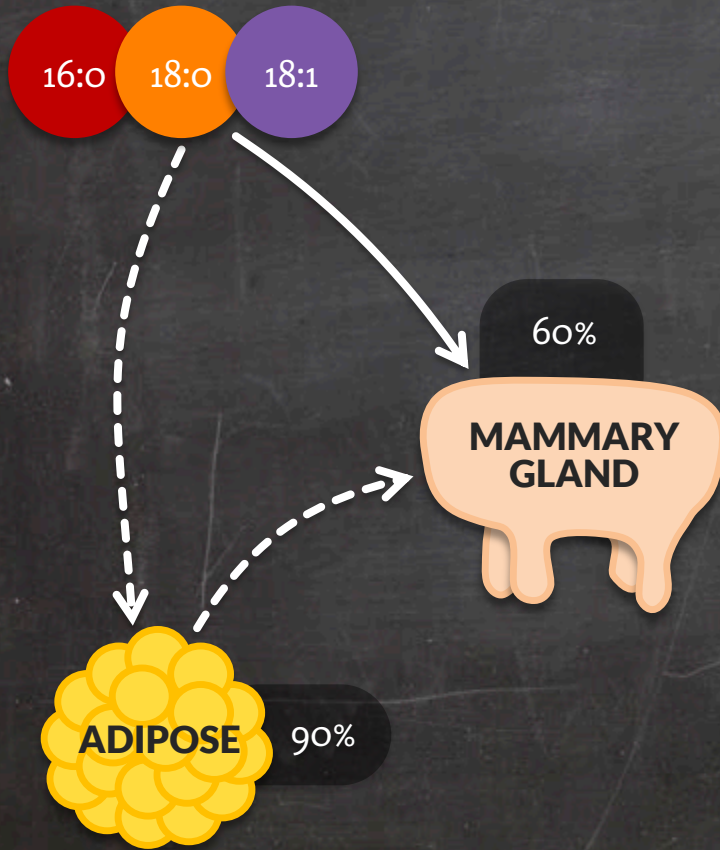




# Feeding Blends of Fatty Acids: Palmitic & Oleic

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- C18:0, under typical feeding situations, is the predominant FA available for absorption by the dairy cow (due to BH)
- Represent the majority of FA in milk fat and adipose tissue
- Predominant FA in the 3 main categories of dietary FA supplements

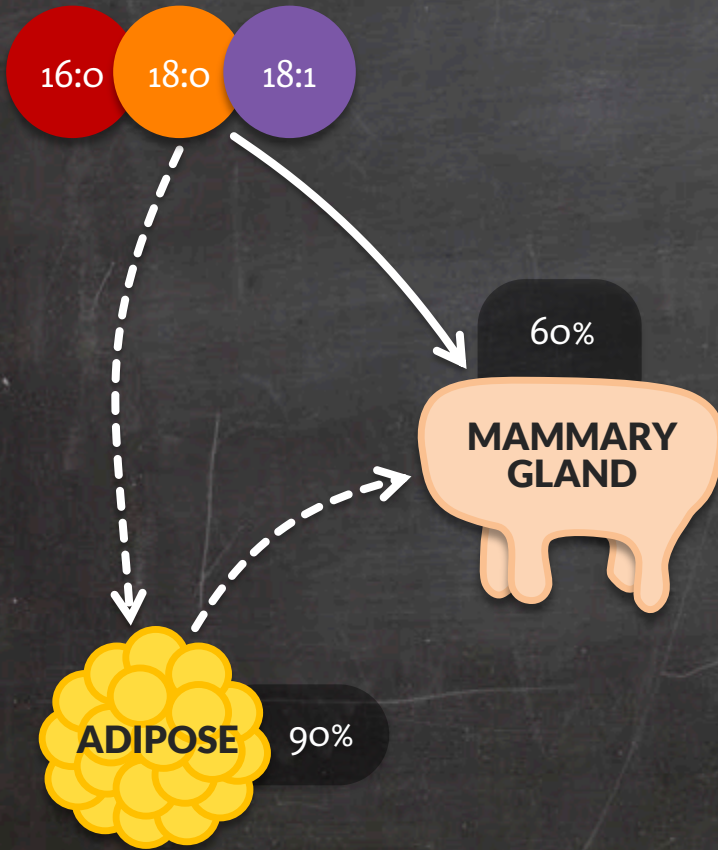




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## Recent Focus on Palmitic, Stearic, and Oleic Acids

Dr. Adam Lock, Michigan State University



- All three FA are important for dairy cow metabolism
- Is there an “ideal” ratio among C16:o, C18:o, and C18:1 to optimize their utilization
- Interactions with other dietary and animal factors



# Feeding Blends of Fatty Acids: Palmitic & Oleic

## 3 Major Categories of FA Supplements Available

Dr. Adam Lock, Michigan State University

### Saturated Free FA Supplements

Fatty Acid, g/100g	Ca-Salt PFAD	Mix	C16:o-Enriched
14:0 Myristic	2.0	2.7	1.6
16:0 Palmitic	51.0	32.8	89.7
18:0 Stearic	4.0	51.4	1.0
18:1 Oleic (n-9)	36.0	5.8	5.9
18:2 C18:2 (n-6)	7.0	0.8	1.3



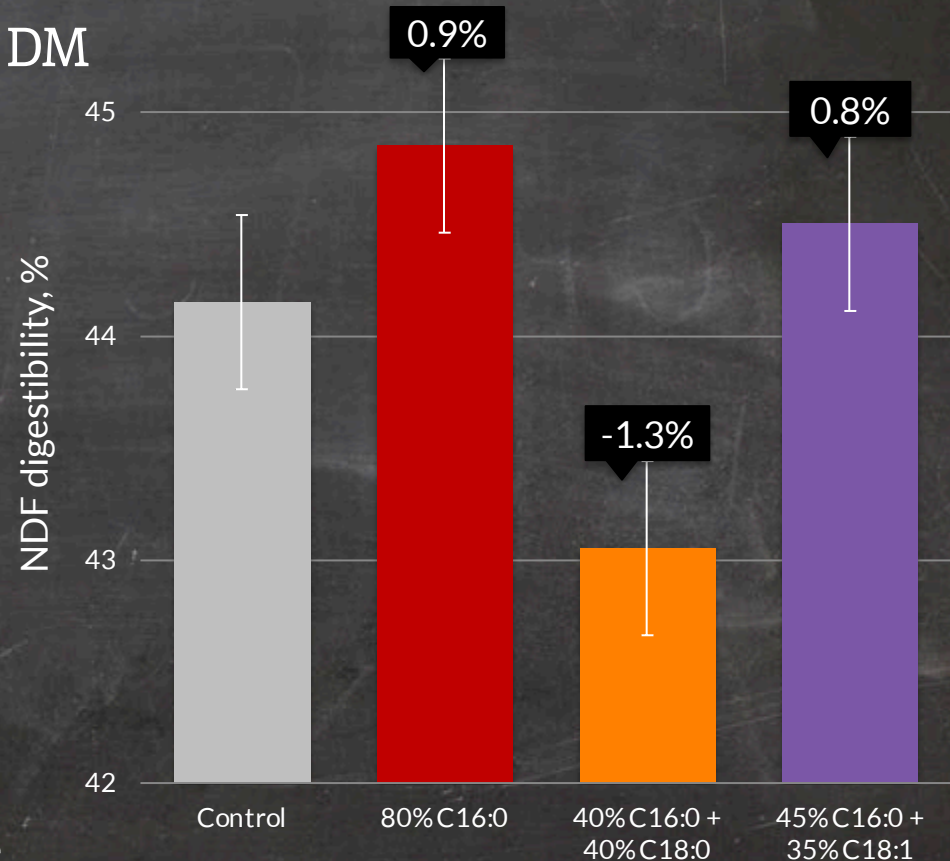


# Feeding Blends of Fatty Acids: Palmitic & Oleic

## Effect of Altering the FA Profile of Supplemental Fats on Apparent Total Tract NDF Digestibility

Dr. Adam Lock, Michigan State University

- Supplement blends fed at 1.5% DM
- Blends of 3 commercially available FA supplements:
  - C16:o-enriched free FA supplement
  - C16:o and C18:o free FA supplement
  - Ca-salt palm FA
- Blended in different ratios to alter content of C16:o, C18:o, and C18:1
- 24 cows in a 4 x 4 Latin square with 21 d periods

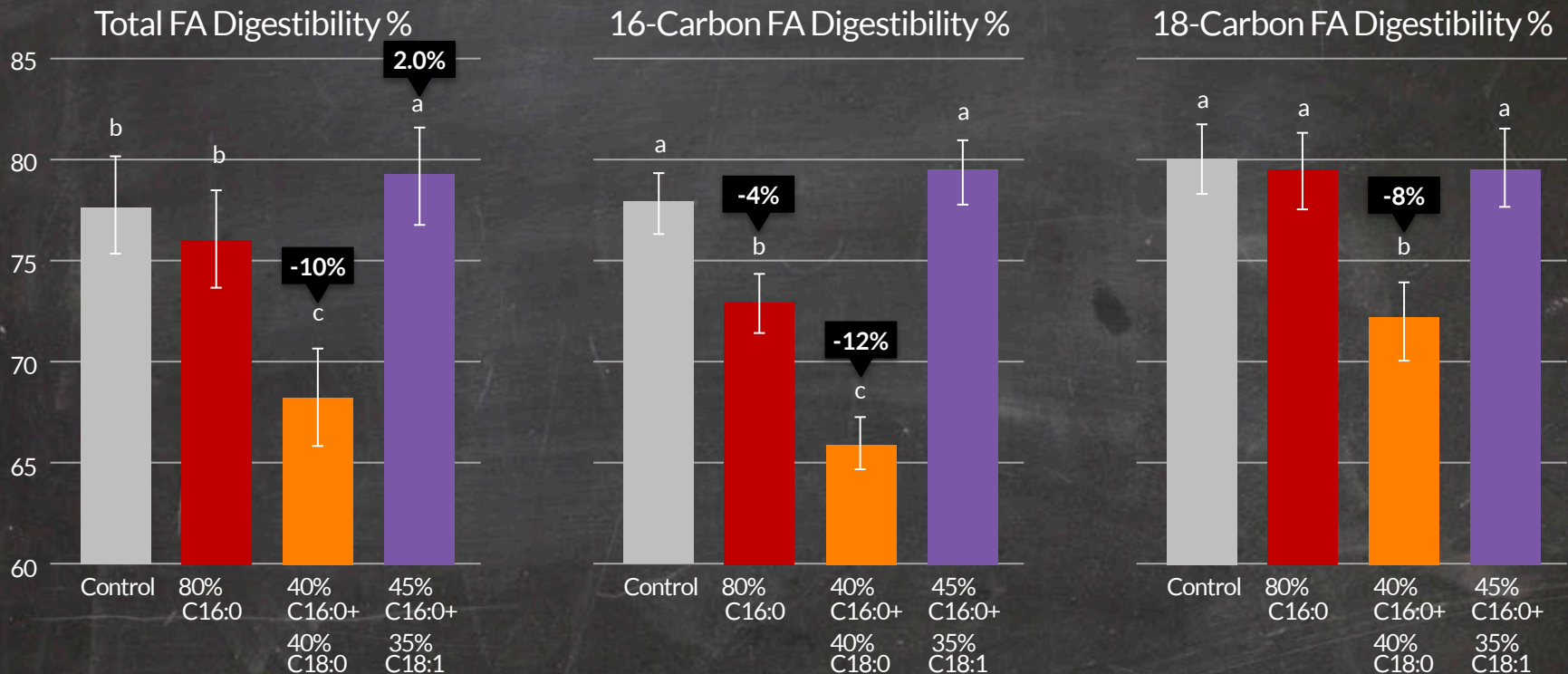


de Souza, et al., 2018. J. Dairy Sci. 101:172–185



# Feeding Blends of Fatty Acids: Palmitic & Oleic Effect of Altering the FA Profile of Supplemental Fats on Apparent Total Tract FA Digestibility

Dr. Adam Lock, Michigan State University



All P value for FA treatment = 0.01

de Souza, et al., 2018. J. Dairy Sci. 101:172–185

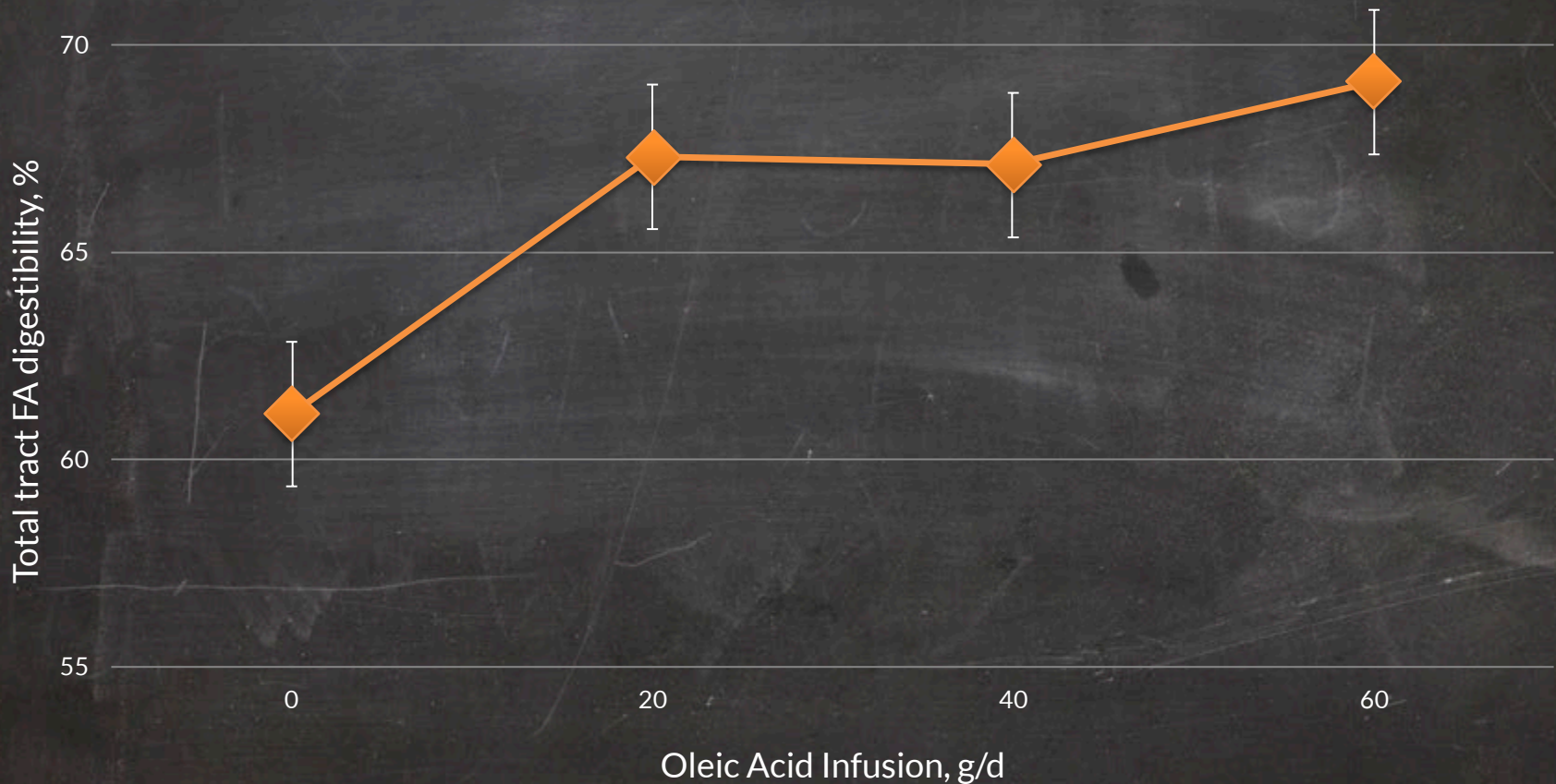




# Feeding Blends of Fatty Acids: Palmitic & Oleic

## Abomasal Infusion of Oleic Acid Improves Total Tract Fatty Acid Digestibility

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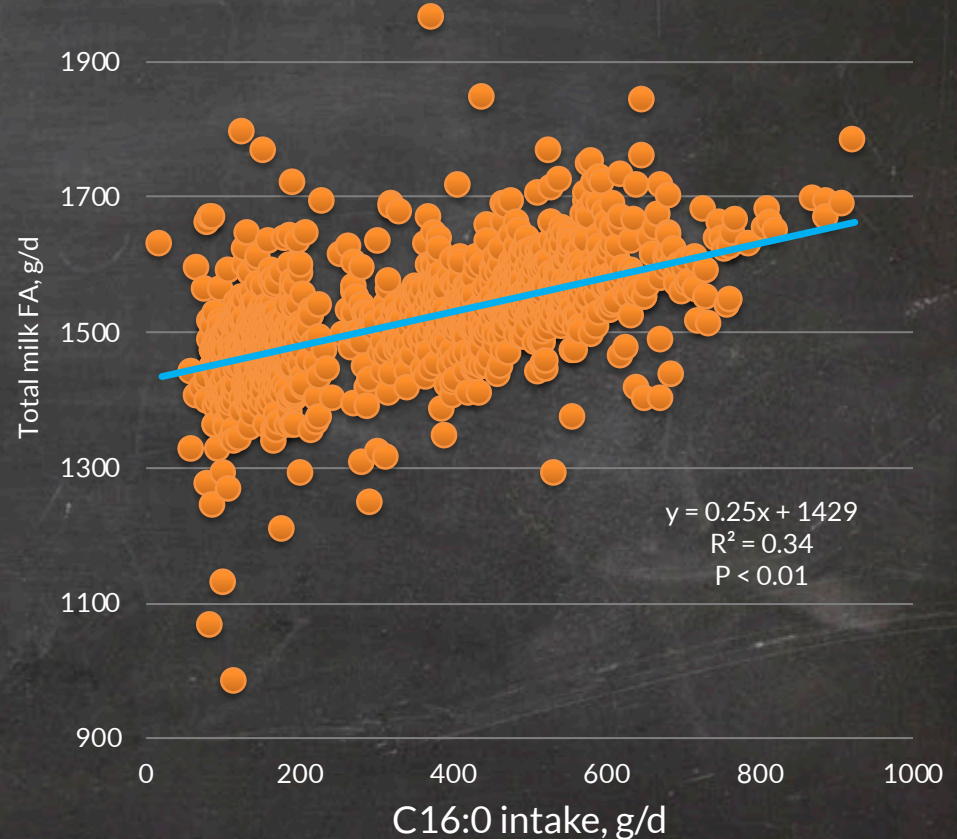
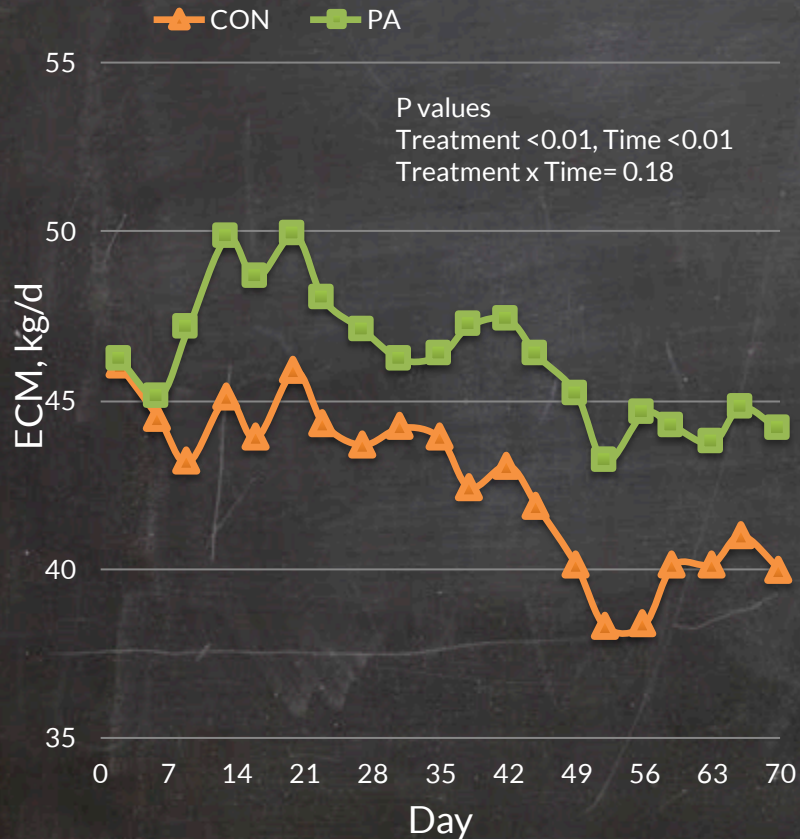
Prom & Lock (ADSA Abstract, 2018)



# Feeding Blends of Fatty Acids: Palmitic & Oleic

## Effect of C16:0 Intake on Fat and Energy-Corrected Milk Yields

Dr. Adam Lock, Michigan State University



de Souza & Lock, 2018. J. Dairy Sci. 101:3044-3056

de Souza & Lock, 2018. TSDNC

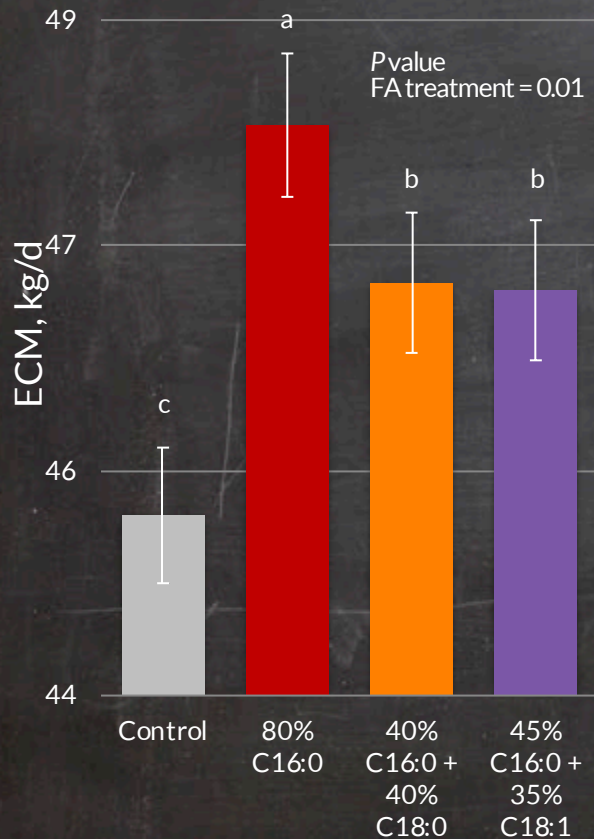




# Feeding Blends of Fatty Acids: Palmitic & Oleic

## Effect of Palmitic, Stearic, and Oleic Acids in Post Peak Cows

Dr. Adam Lock, Michigan State University



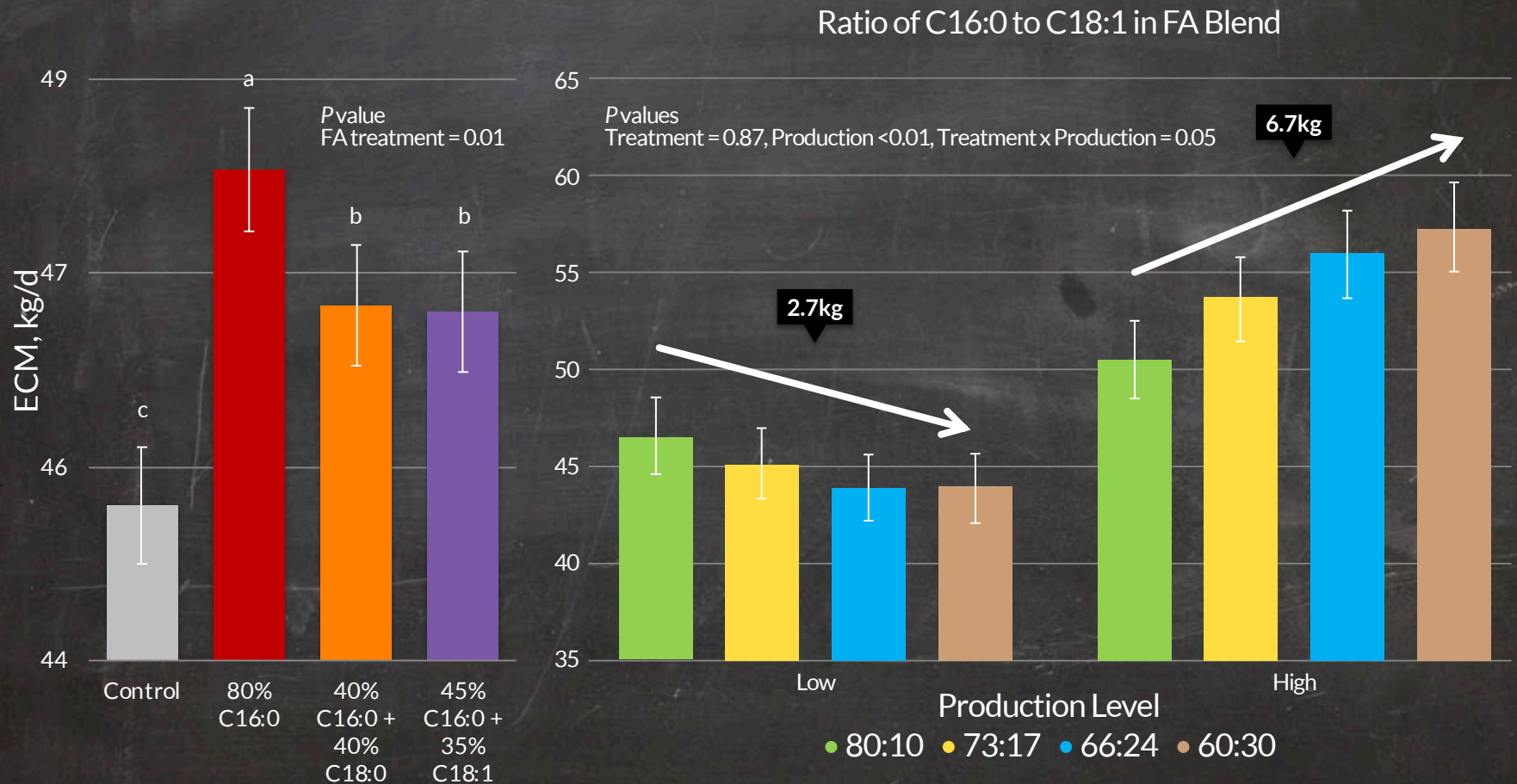
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de Souza et al. 2019. J. Dairy Sci. in press



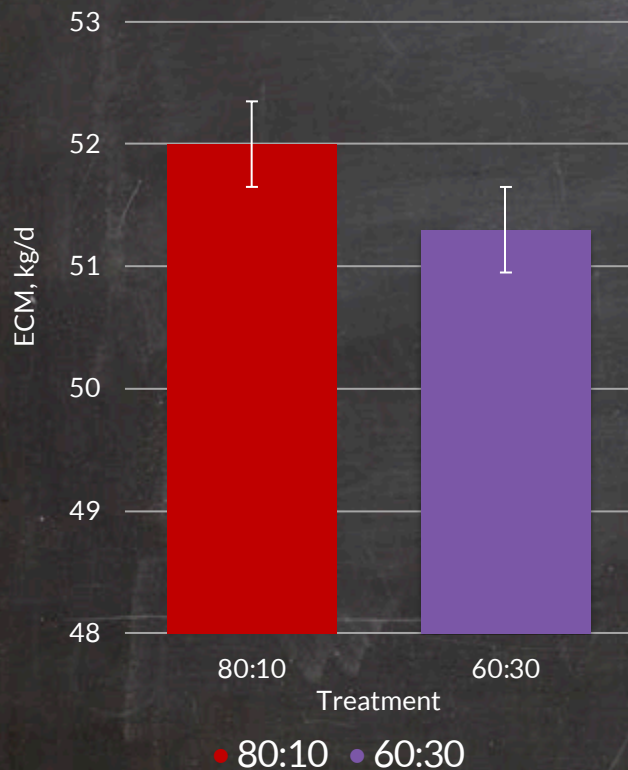


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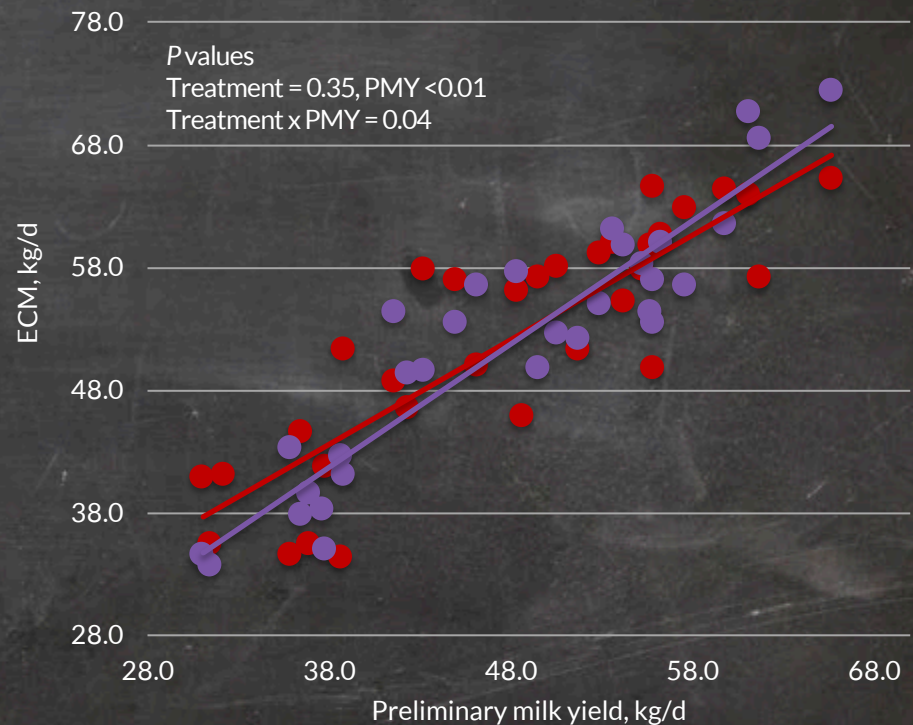
## Effect of Palmitic to Oleic Ratio and Production Level on ECM

Dr. Adam Lock, Michigan State University

Ratio of C16:0 to cis-9 C18:1 in FA blend



32 cows in a cross over study with 21 d periods  
Supplements fed at 1.5% DM; blends made using combinations of commercially available C16:0-enriched and Ca-salts palm oil supplements



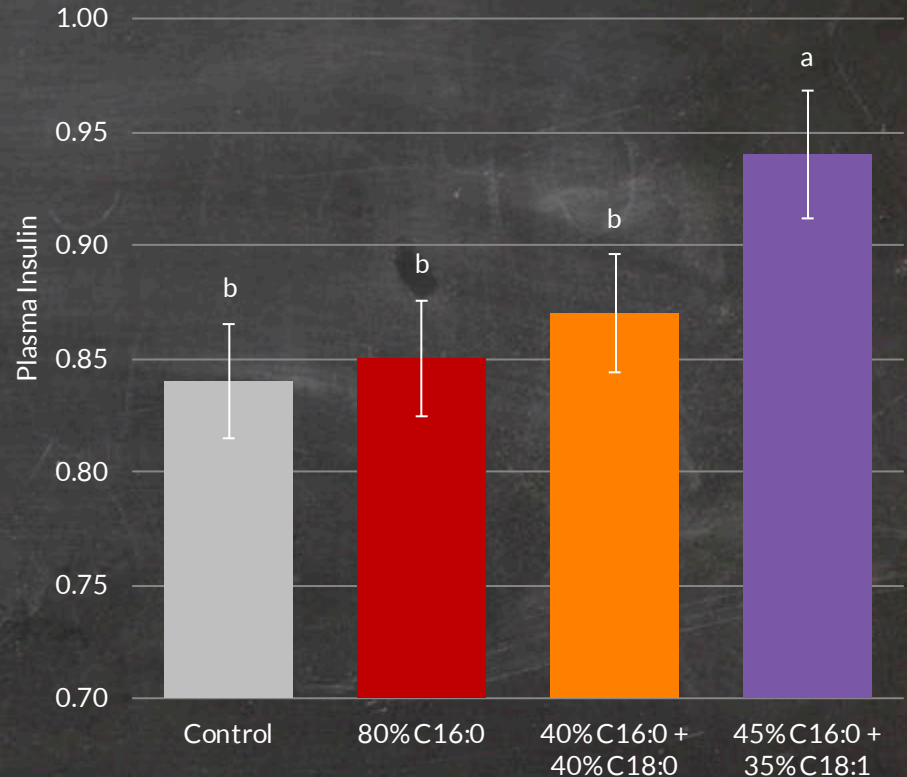
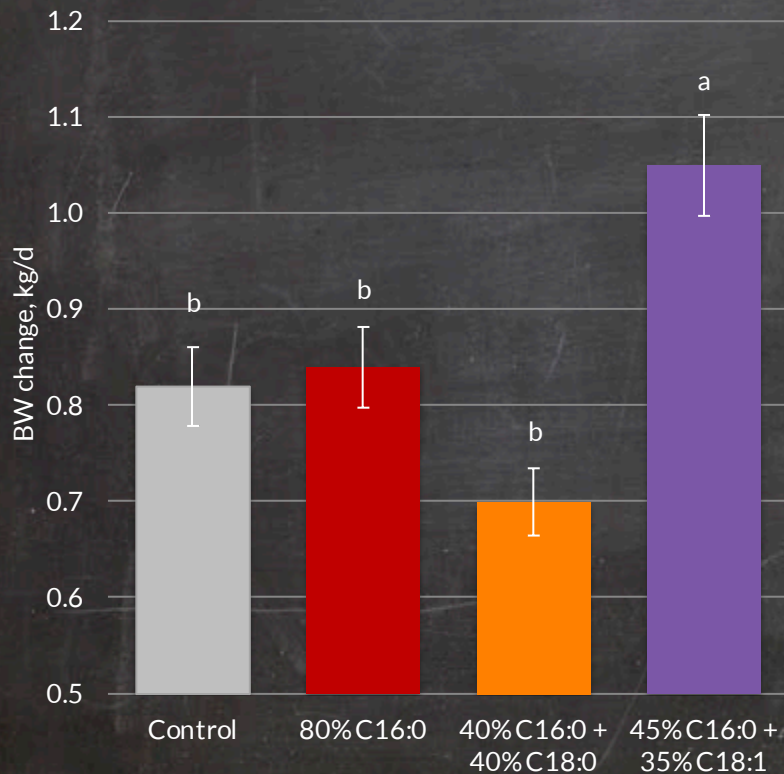
Western, de Souza & Lock (ADSA Abstract 2018)



# Feeding Blends of Fatty Acids: Palmitic & Oleic

## Effect of Altering the FA Profile of Supplemental Fats on BW and Insulin

Dr. Adam Lock, Michigan State University



All P value for FA treatment = 0.01

de Souza & Lock, 2018. TSDNC



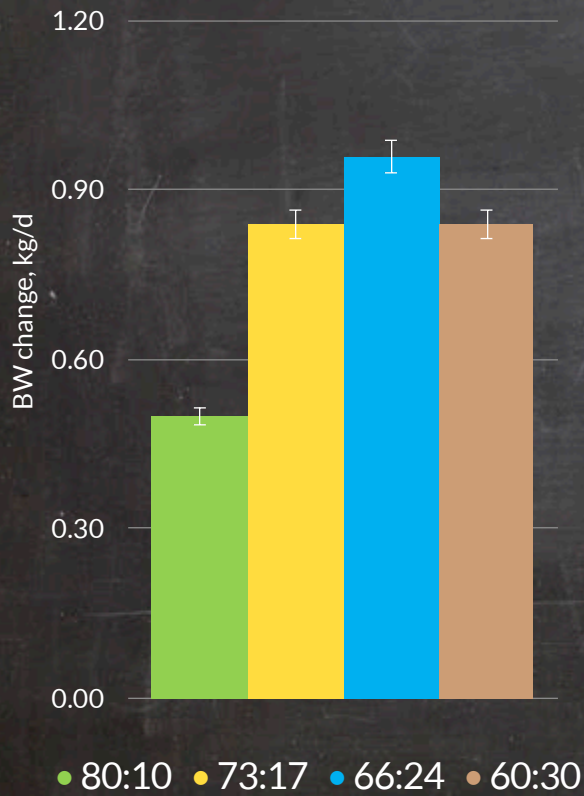


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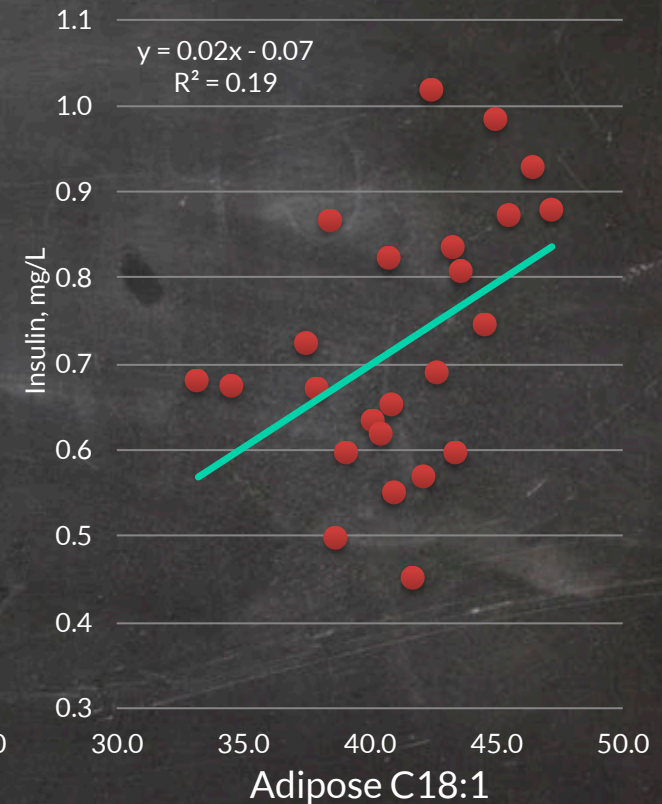
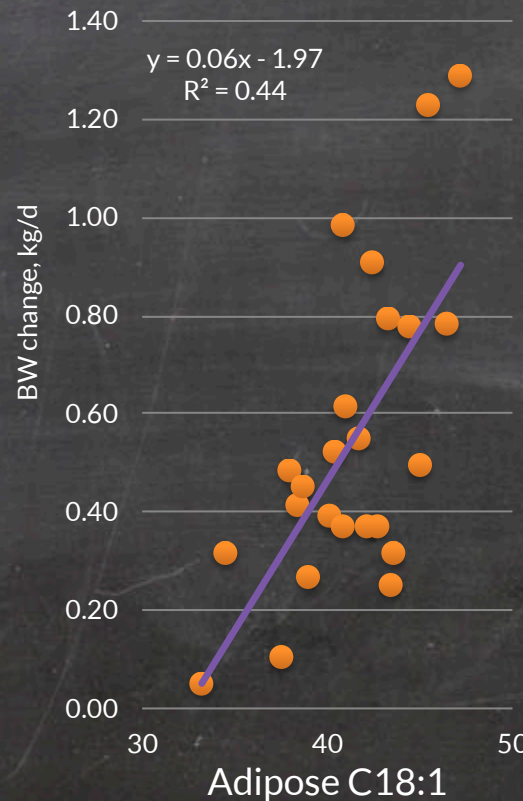
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Dr. Adam Lock, Michigan State University

Ratio of C16:0 to C18:1 in FA Blend



de Souza et. al. 2019. J. Dairy Sci. in press



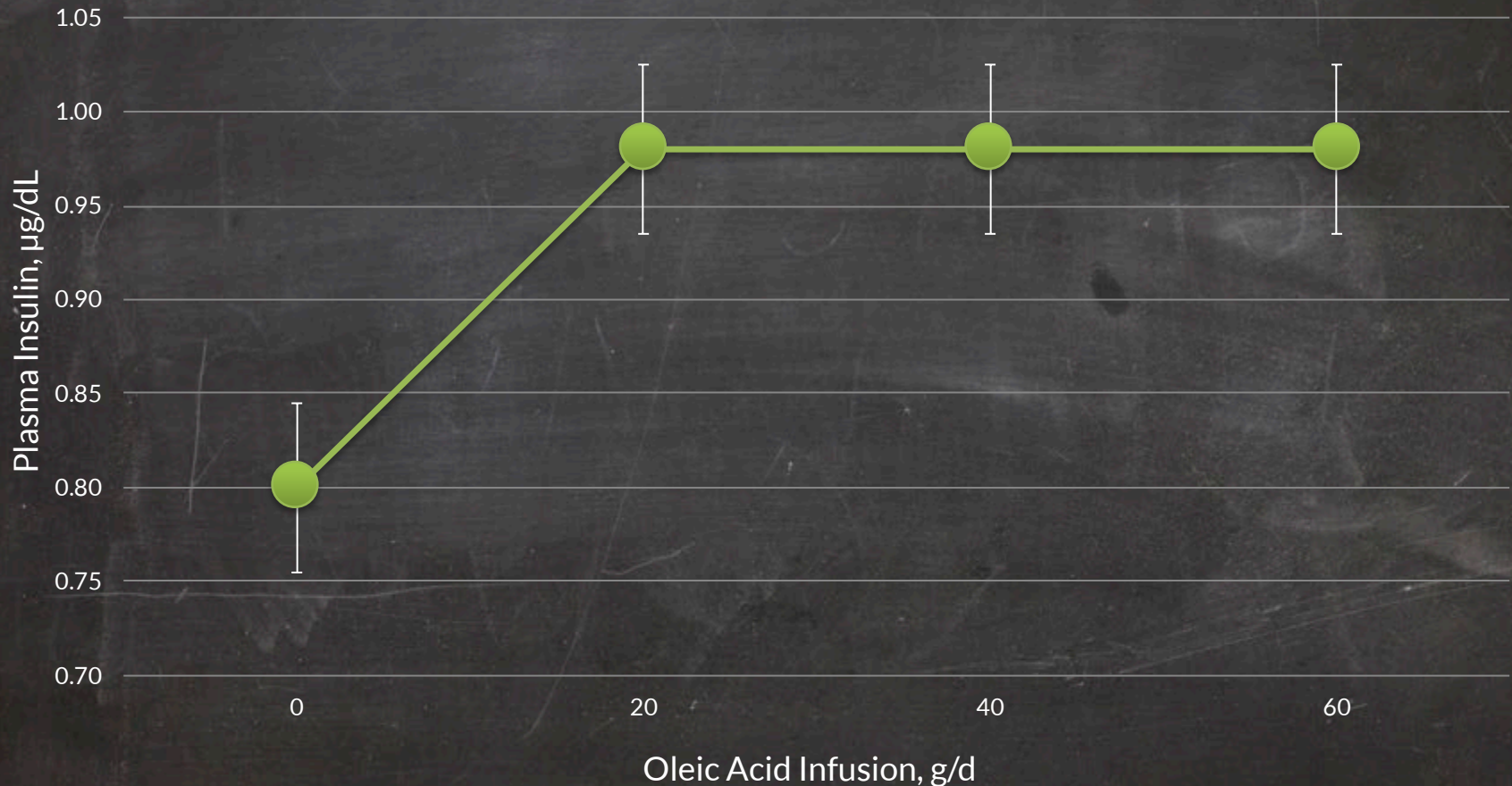
de Souza & Lock (ADSA Abstract 2017)



# Feeding Blends of Fatty Acids: Palmitic & Oleic

## Abomasal Infusion of Oleic Acid Increases Plasma Insulin in Post Peak Cows

Dr. Adam Lock, Michigan State University



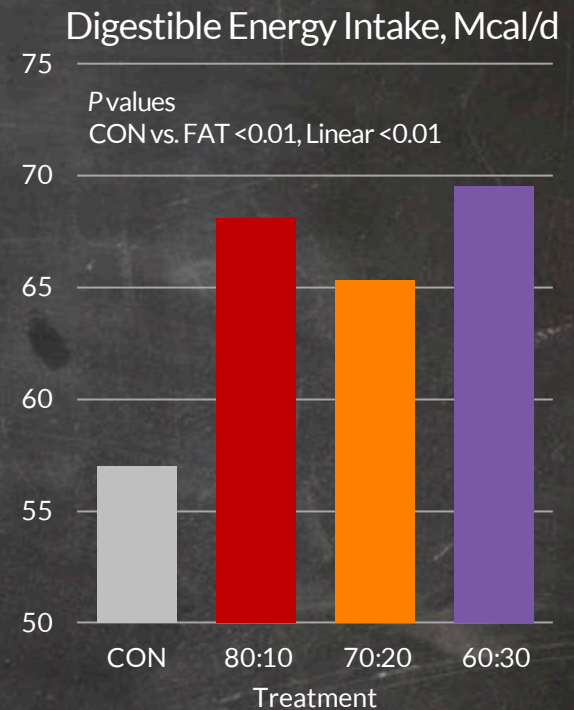
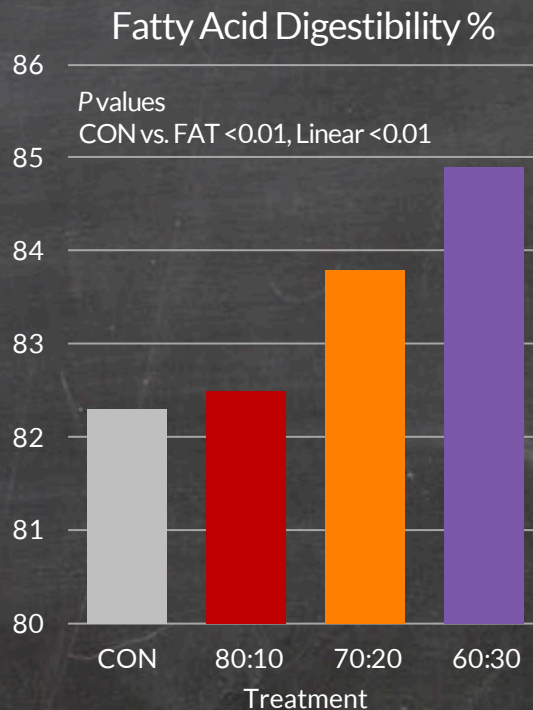
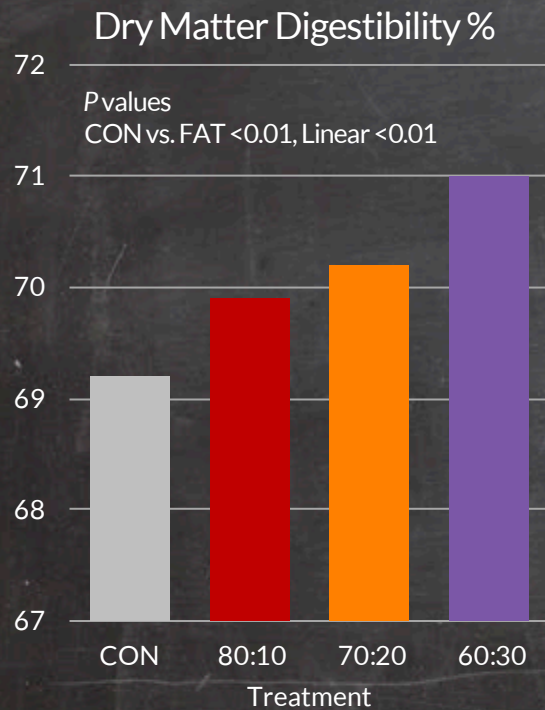
Prom et al. (ADSA Abstract, 2018)





# Feeding Blends of Fatty Acids: Palmitic & Oleic Effect of Altering the Palmitic to Oleic Acid Ratio of Supplemental Fats to Fresh Cows

Dr. Adam Lock, Michigan State University



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

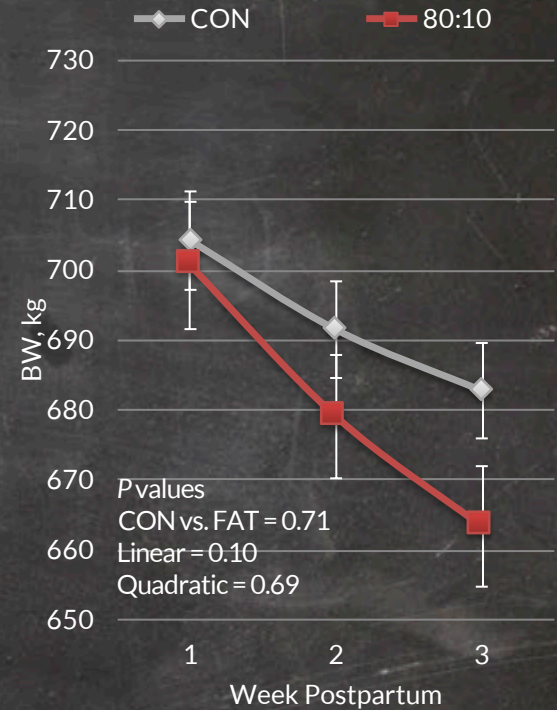
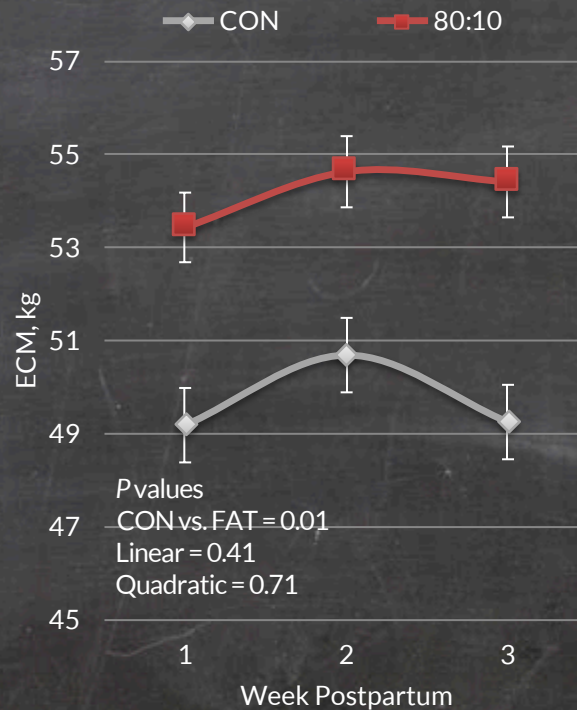
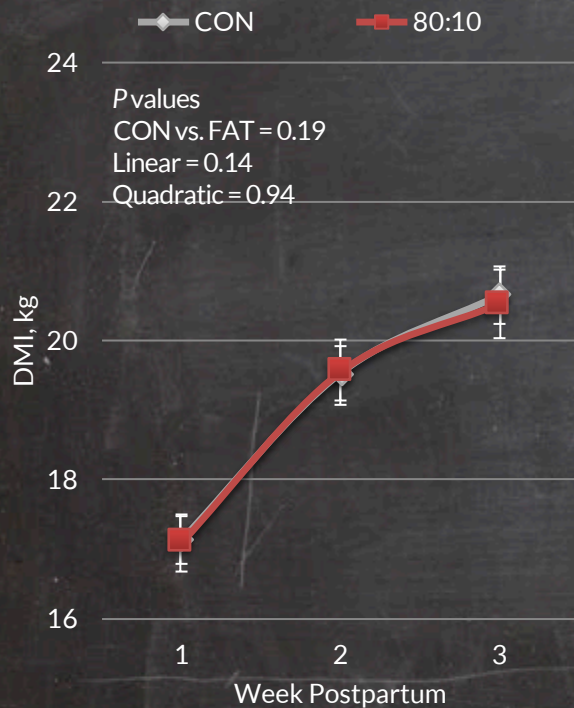
de Souza, Prom, & Lock (ADSA 2019)



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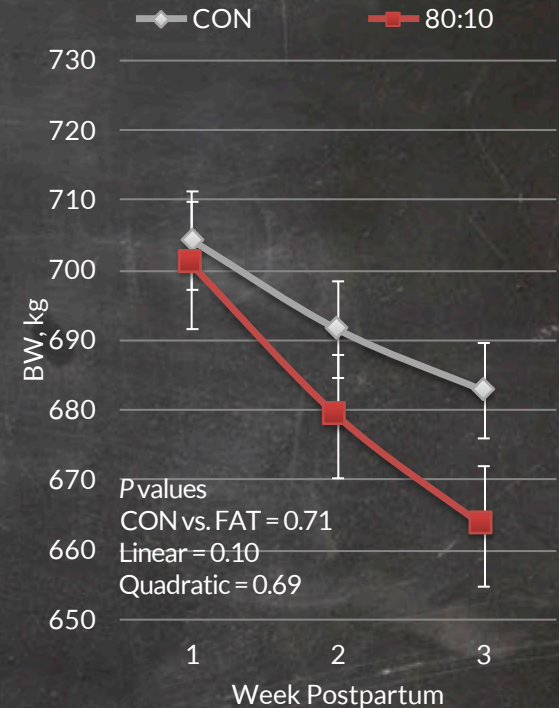
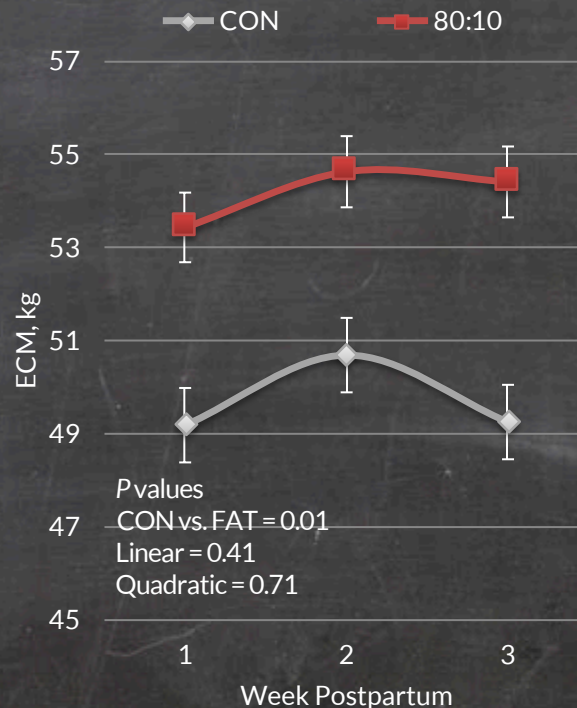
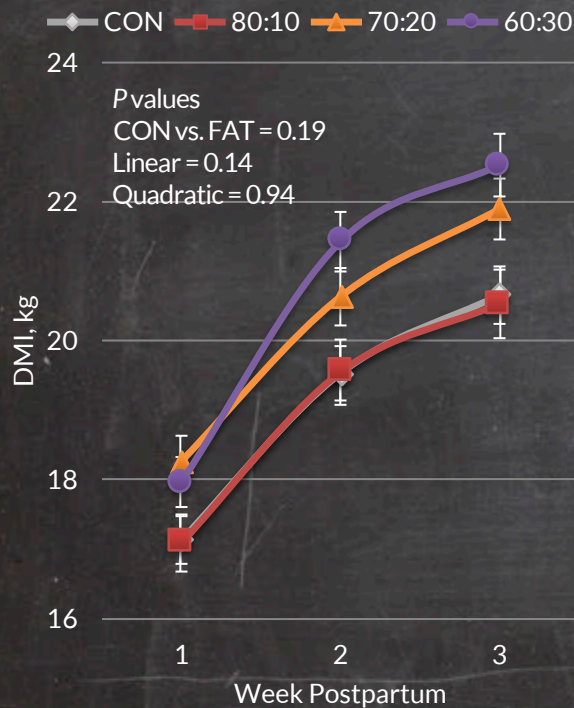




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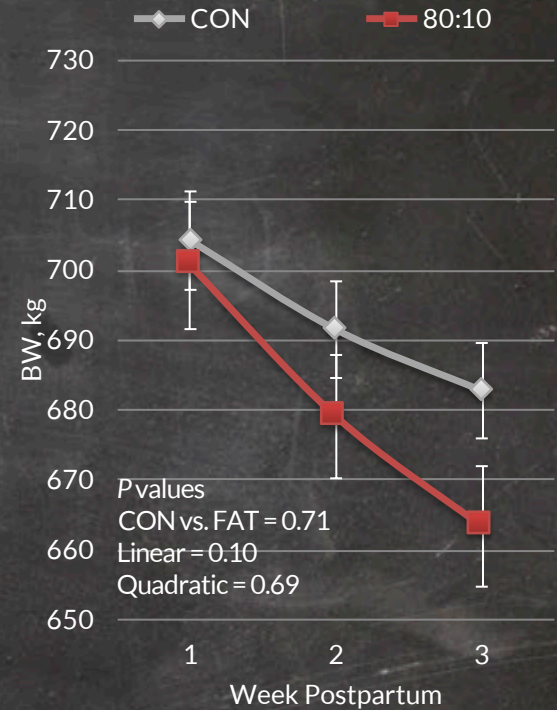
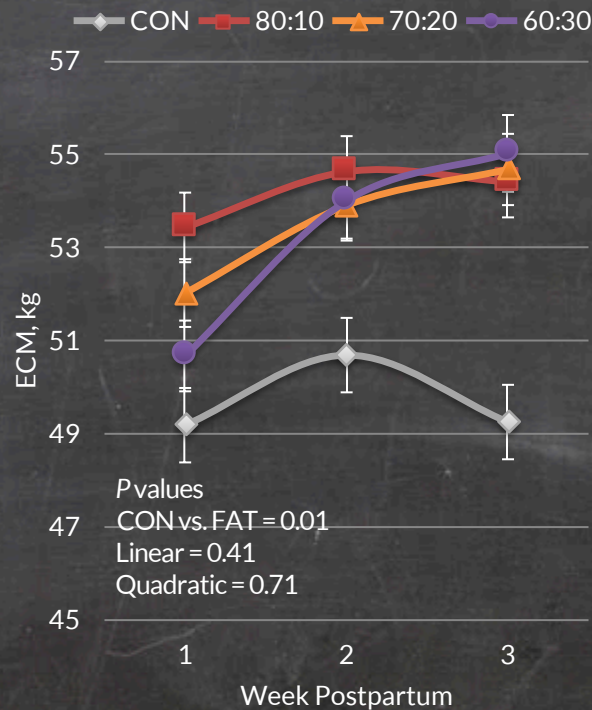
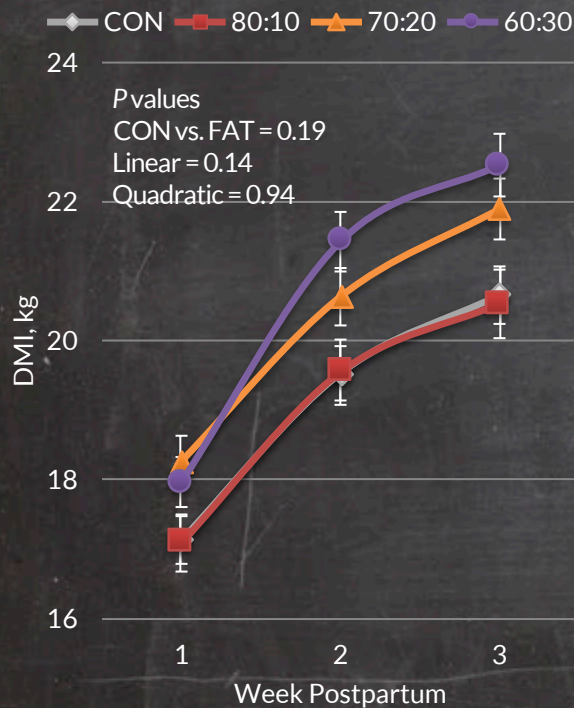
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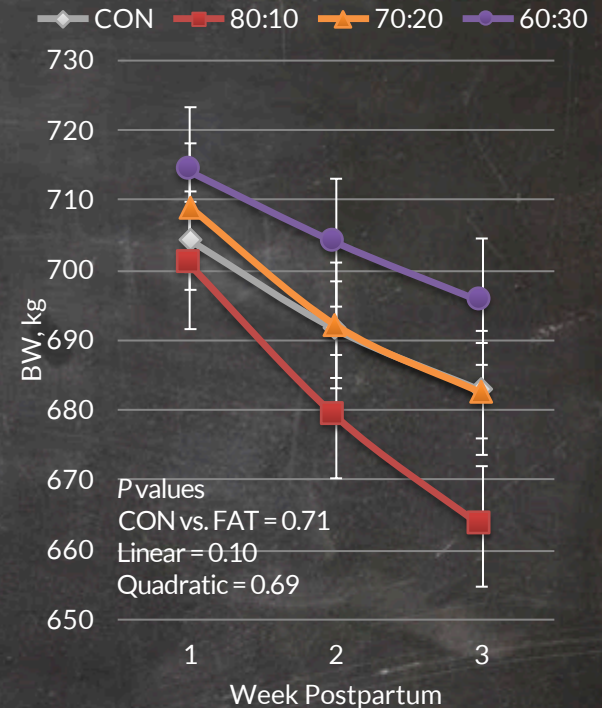
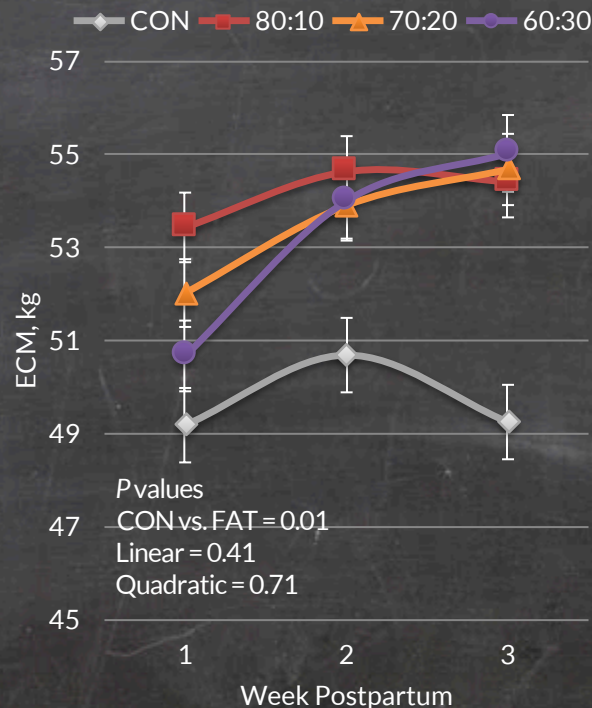
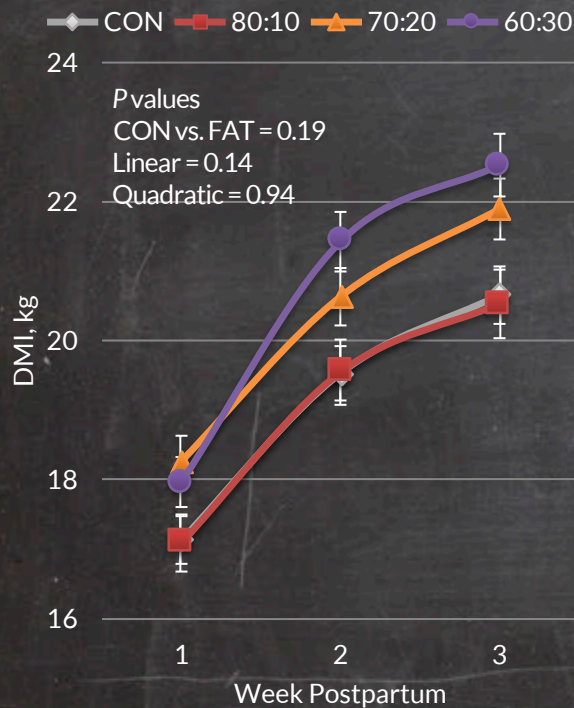




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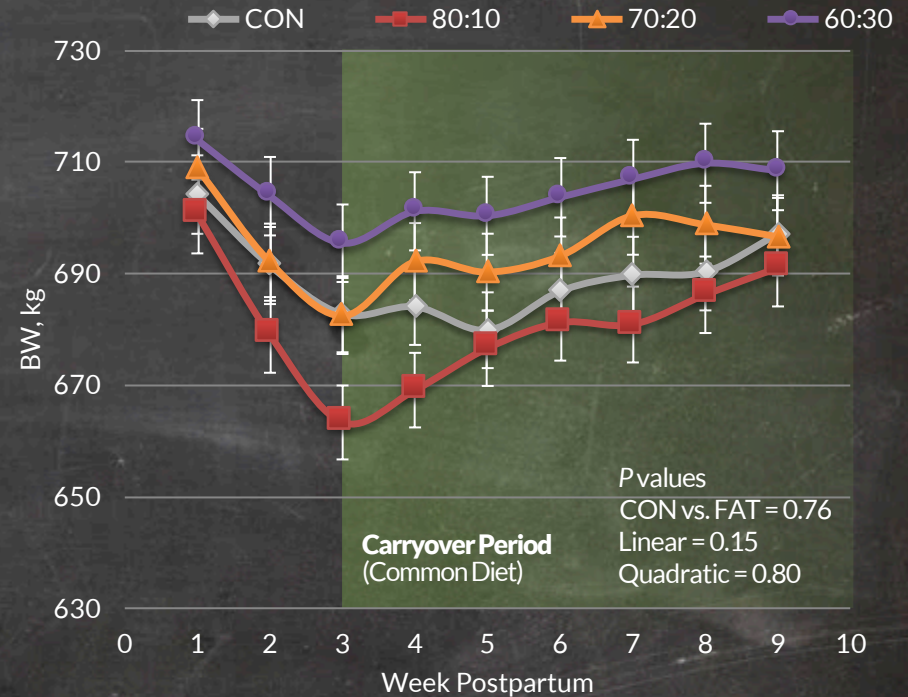
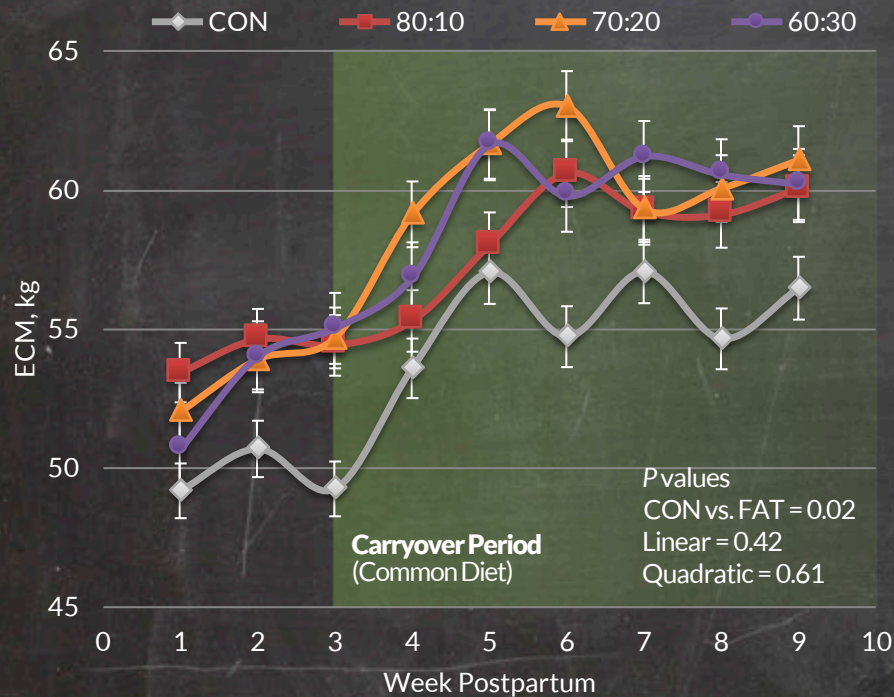
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de Souza, Prom, & Lock (ADSA 2018)



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de Souza, Prom, & Lock (ADSA 2018)





# Feeding Blends of Fatty Acids: Palmitic & Oleic

## Abomasal Infusion of Oleic Acid in Fresh Cows

Dr. Adam Lock, Michigan State University

- 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

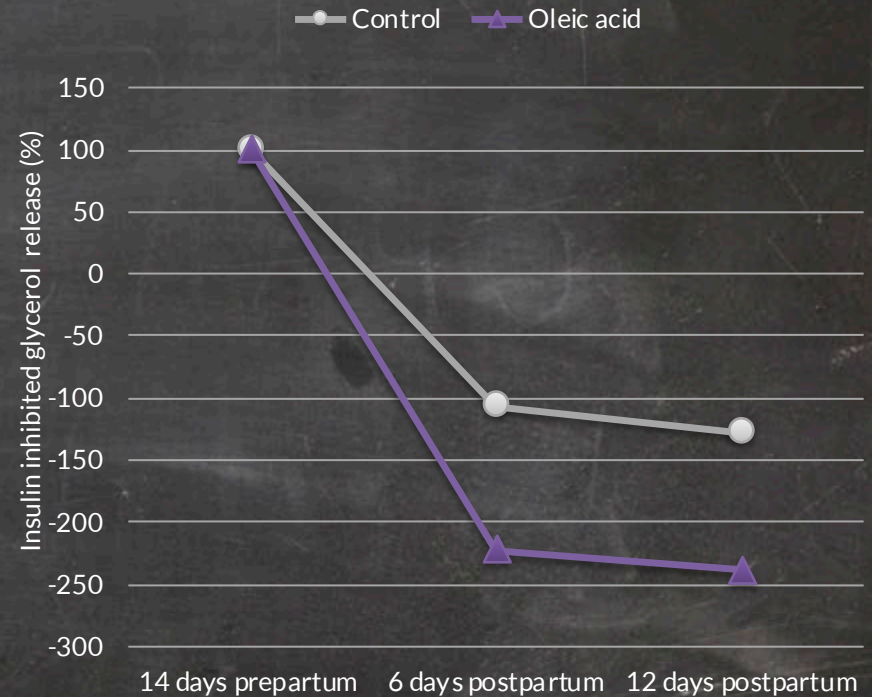
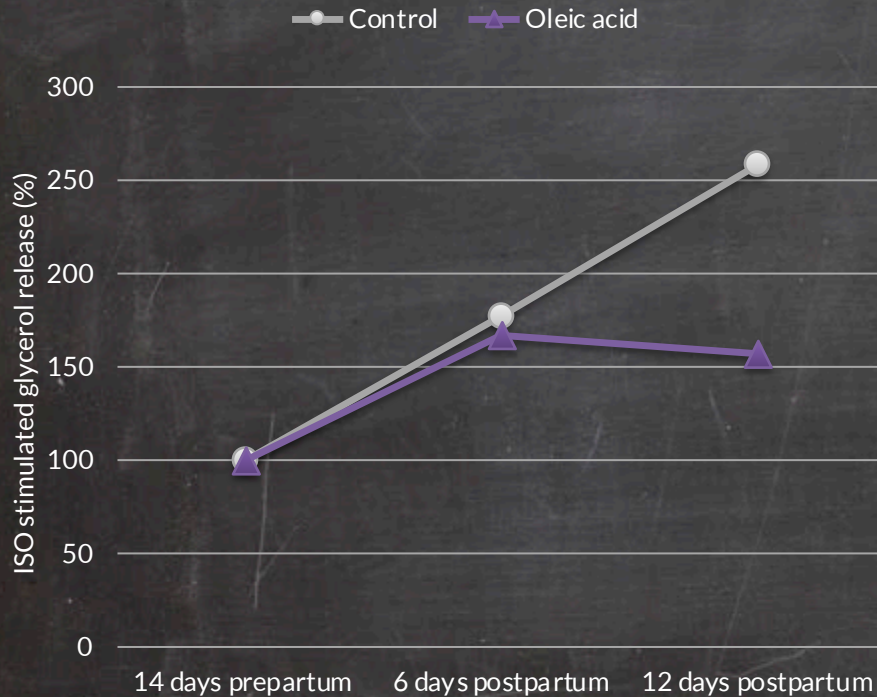




# Feeding Blends of Fatty Acids: Palmitic & Oleic

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

Dr. Adam Lock, Michigan State University



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

Laguna et al. (ADSA 2019)





# Feeding Blends of Fatty Acids: Palmitic & Oleic Summary

Dr. Adam Lock, Michigan State University

- Our understanding of FA digestion and metabolism in dairy cows has advanced significantly in the last few decades
- Presented research focusing on specific FA and how dairy cows respond differently to combinations of FA
- Important to consider possible effects of FA in the rumen (BH/MFD/NDFd), in the small intestine (DMI/digestibility), in the mammary gland (increased incorporation/substitution), and energy partitioning between tissues
- Digestibility appears to be a good indicator of inclusion or not of a FA in a supplement, assuming that this source of FA does not markedly affect DMI
- Use of supplemental FA in the fresh period should be considered; new research suggests that FA supplementation increases performance in fresh COWS



# Feeding Blends of Fatty Acids: Palmitic & Oleic Summary

Dr. Adam Lock, Michigan State University

- Profile of supplemental FA key in determining production responses and energy partitioning
  1. C16:o drives increases in milk fat yield and ECM partially due to a decrease in BW
  2. C16:o and C18:1 drives increases in milk yield and ECM without changing BW loss compared to non-supplemental diet
  3. Feeding FA supplements in the fresh period has carryover effects on early lactation
- Opportunity and challenge will be to continue to improve our understanding of how and which FA affect nutrient digestion, energy partitioning, and milk synthesis in lactating dairy cows, applying this knowledge in the feeding and management of today's high producing dairy cows
- Recommendation: consider use of FA supplements containing C16:o and C18:1





# Feeding Blends of Fatty Acids: Palmitic & Oleic Acknowledgments

Dr. Adam Lock, Michigan State University



United States Department of Agriculture  
National Institute of Food and Agriculture



Animal Nutrition





# Feeding Blends of Fatty Acids: Palmitic & Oleic

## Contact

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**Extension**