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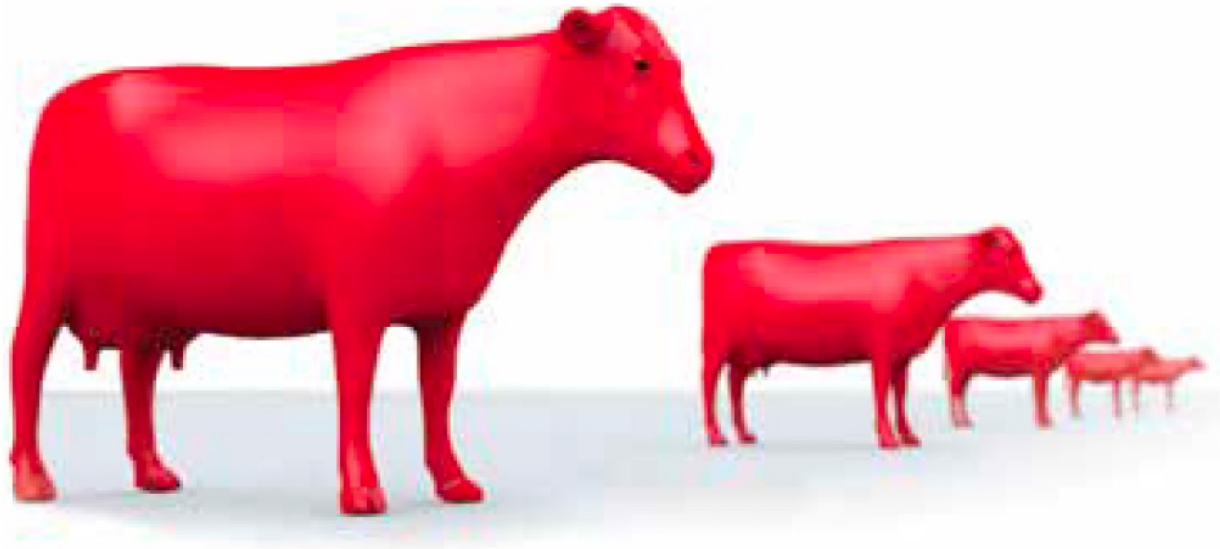
How do we get the next five pounds of milk?

Dr. Barry Bradford
Michigan State University

Tuesday, February 28
11:20 –11:50 AM
Room: Tuscany 8



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How do we get the next 5 pounds of milk?

Barry Bradford

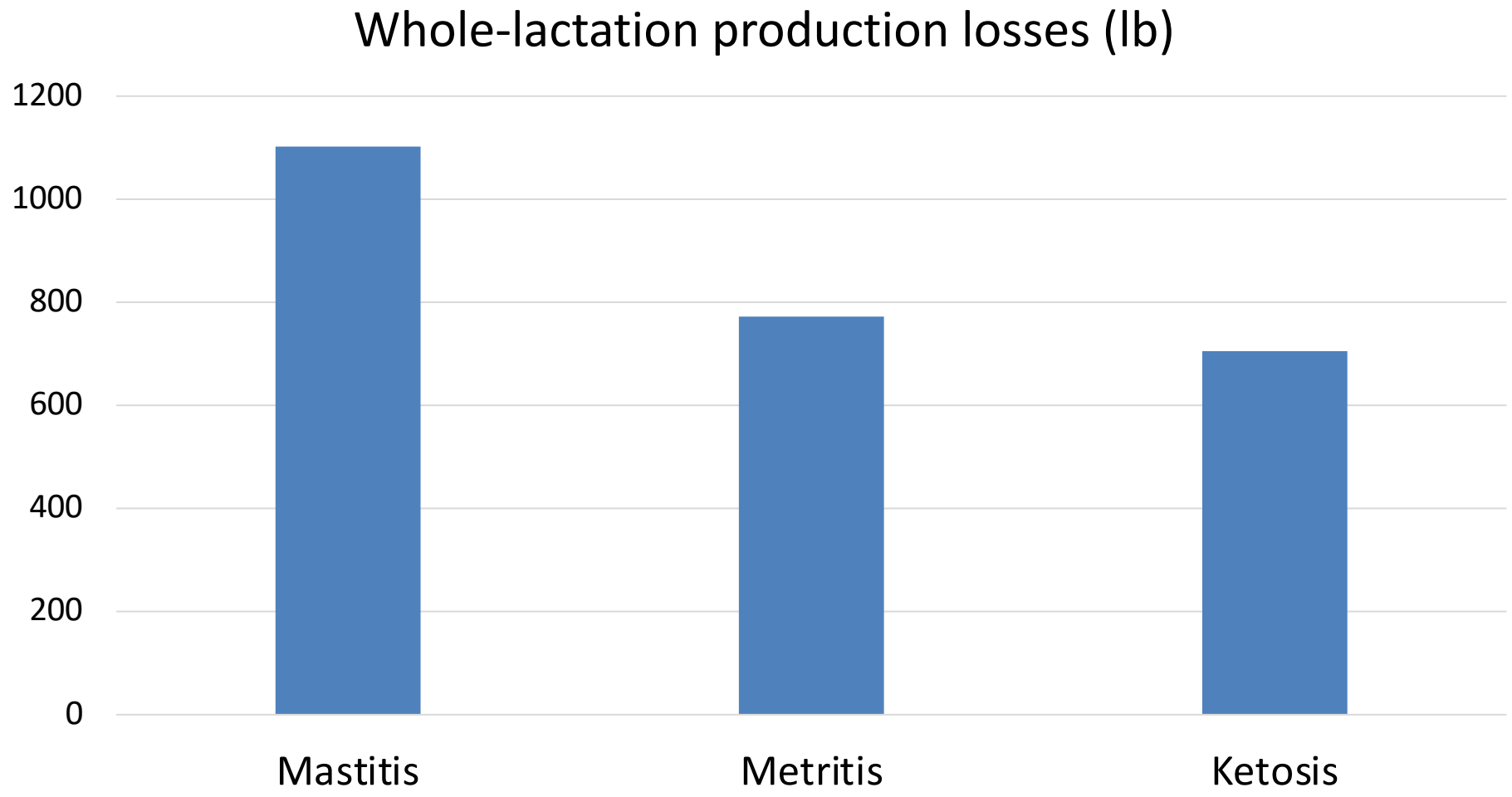
Michigan State University

How do we get the next 5 pounds of milk?

1. Refine feeding strategies to better meet metabolic needs and equip the mammary gland with the necessary nutrients for milk.

2. Prevent the clinical + subclinical transition cow problems that impact productivity of 20-40% of our cows. (5 lb/d x 30%)

Long-term consequences of transition problems



Seegers 2003; Deluyker 1991; Wittrock 2011; Ospina 2010; Seifi 2011

How do we get the next 5 pounds of milk?

1. Refine feeding strategies to better meet metabolic needs and equip the mammary gland with the necessary nutrients for milk.

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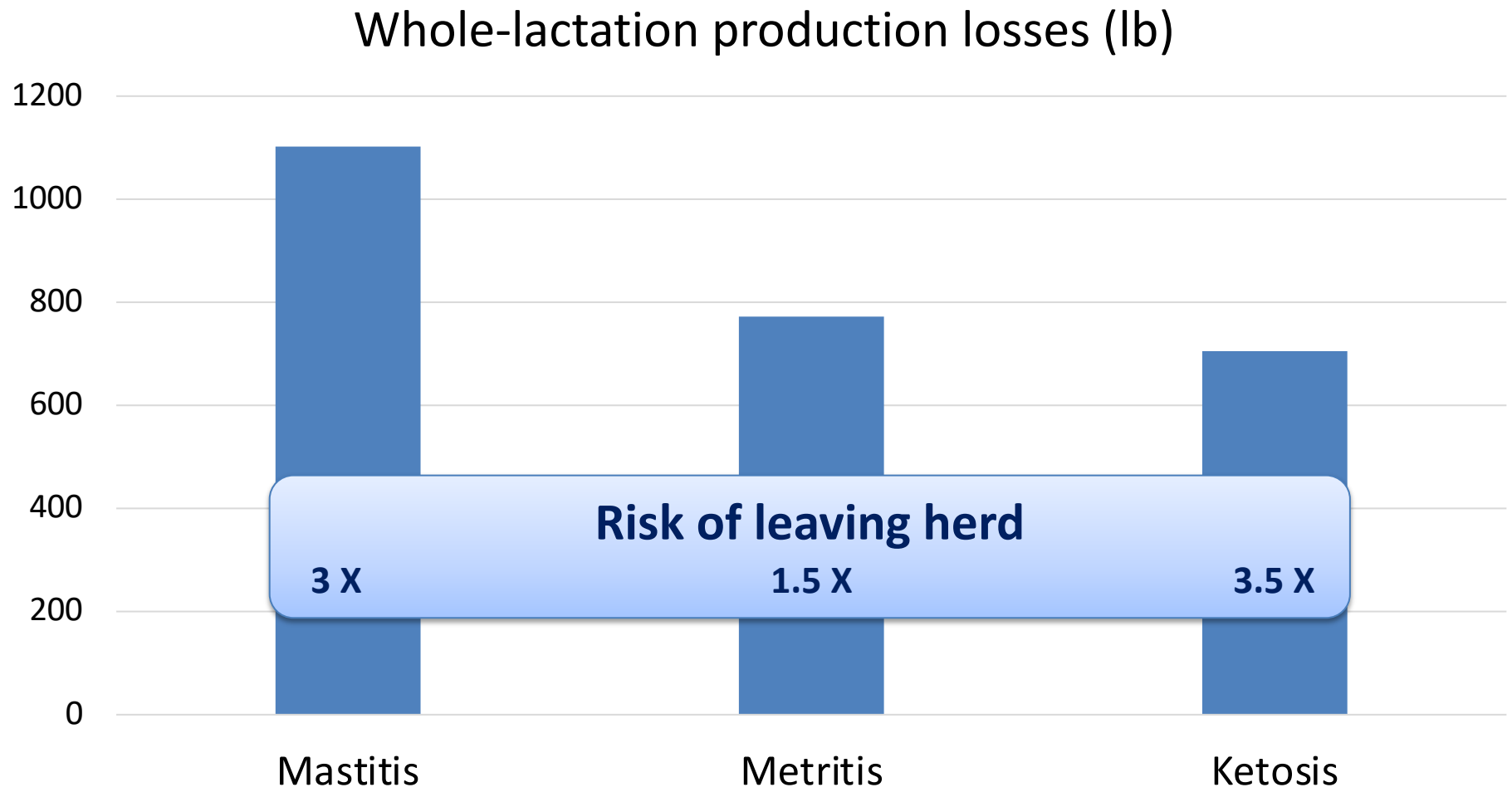
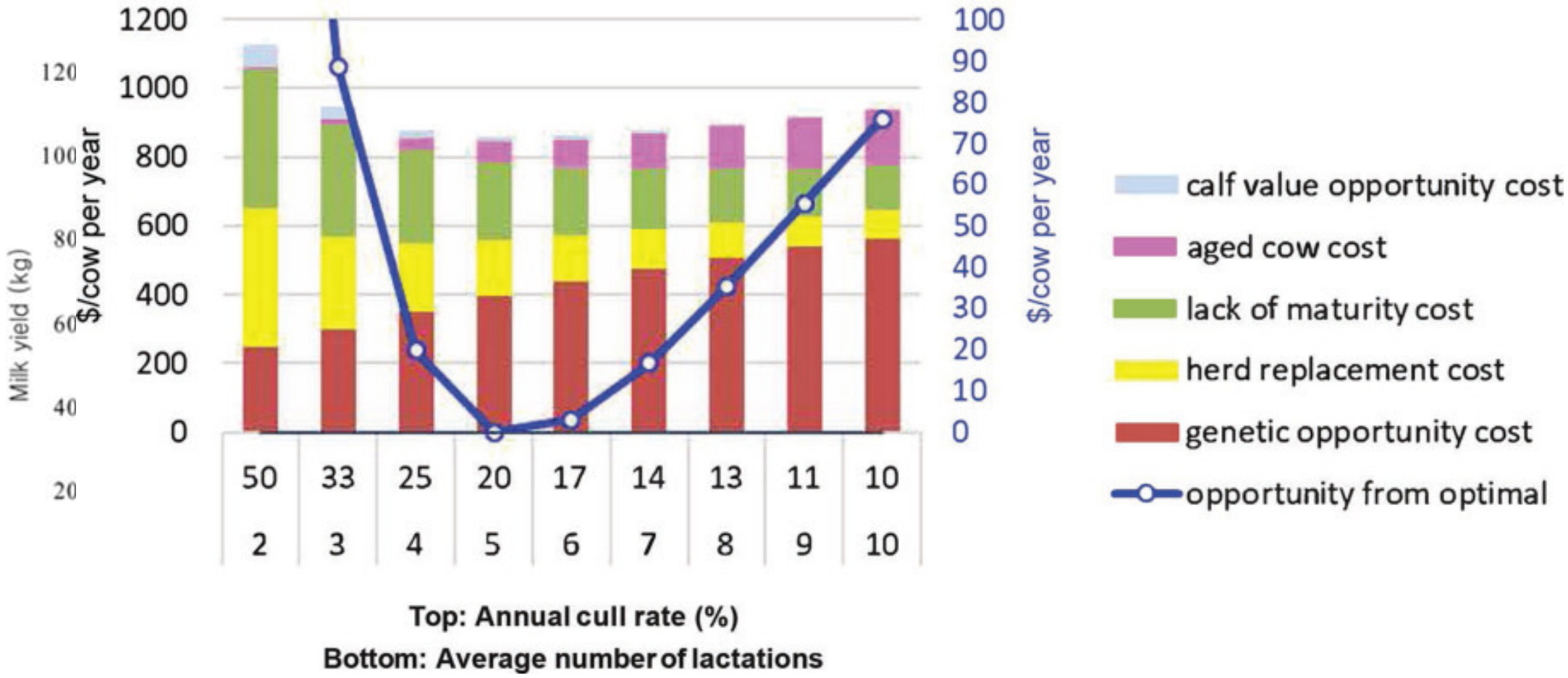
Long-term consequences of transition problems



Seegers 2003; Deluyker 1991; Wittrock 2011; Ospina 2010; Seifi 2011

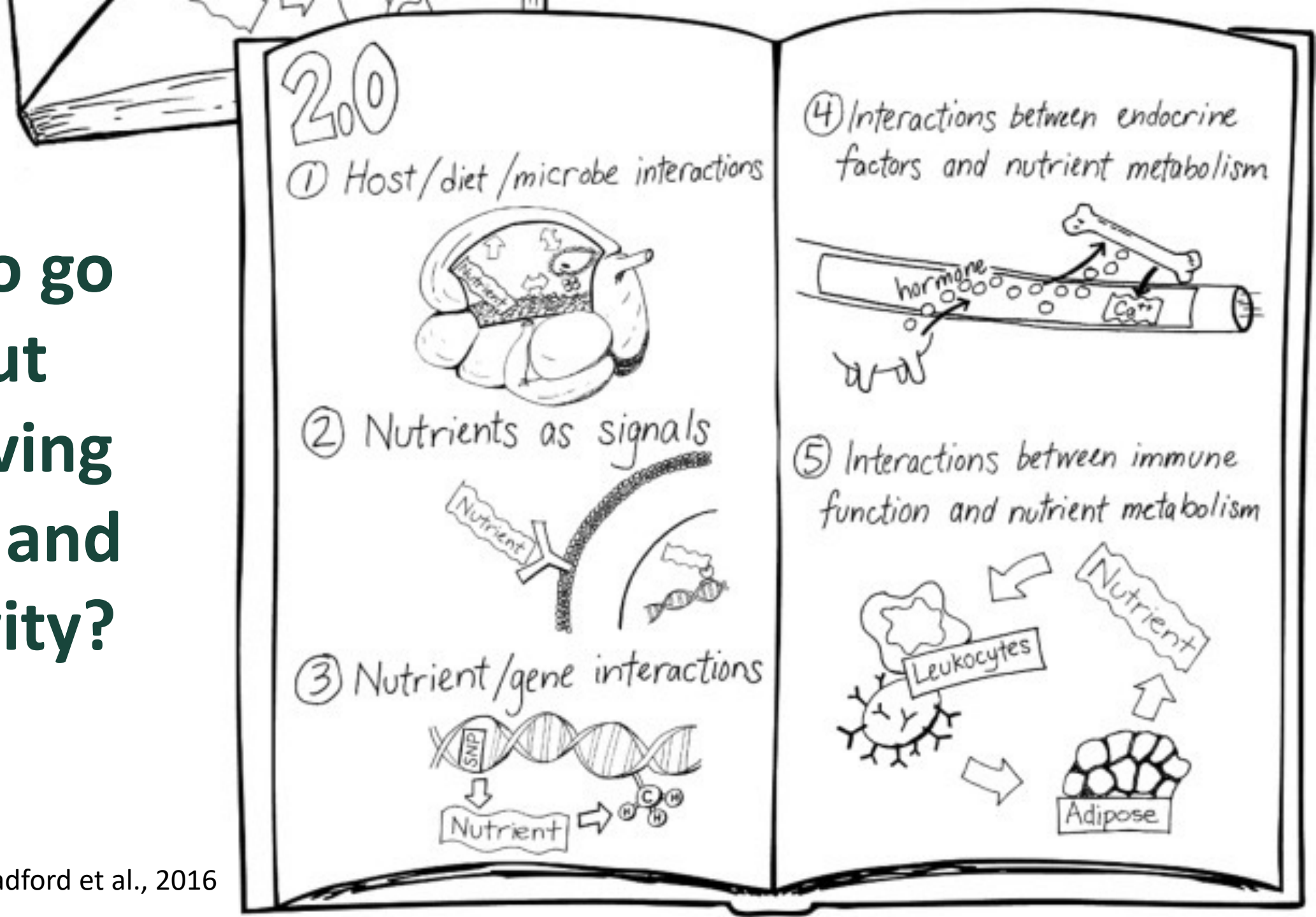
Productivity & profitability increase until lactation 4-5



Lee and Kim, 2006

De Vries, 2020

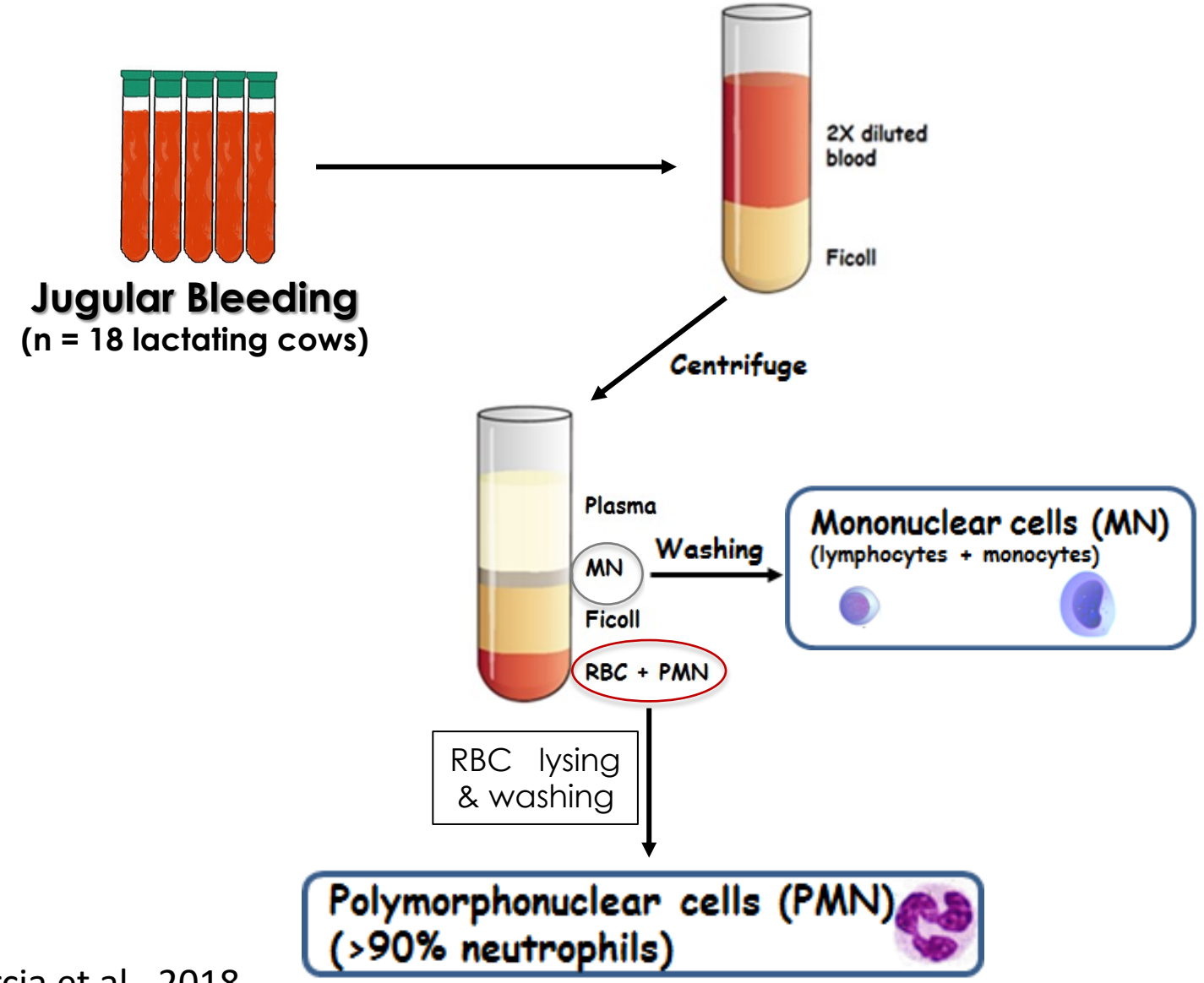
How to go about improving health and longevity?



Bradford et al., 2016

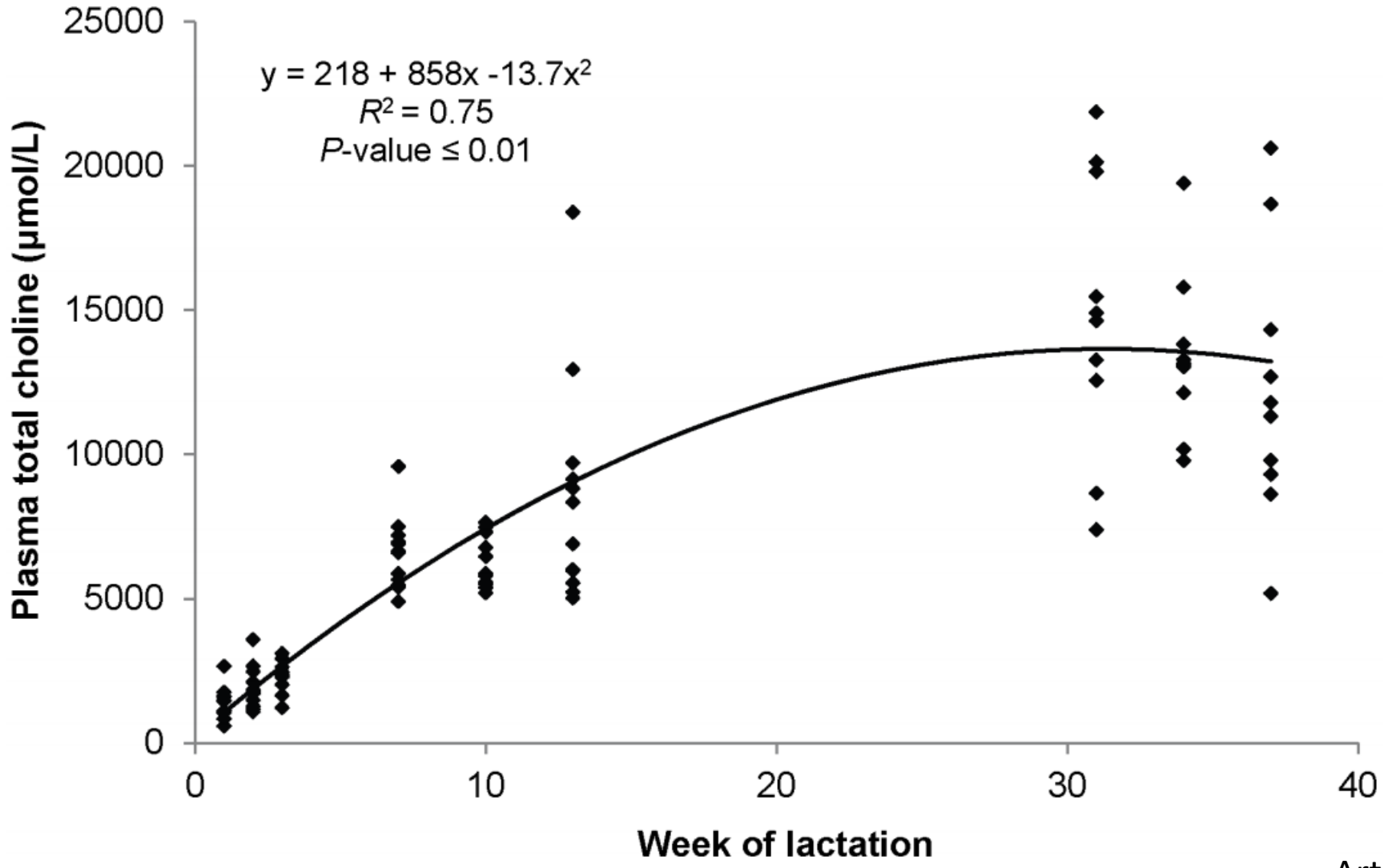
Choline can affect immune cells

- Exposing immune cells to choline in the lab **decreased inflammation** after endotoxin stimulation
- Choline **enhanced** responses of cells involved in **immune memory**



Garcia et al., 2018

Choline in lactating cows

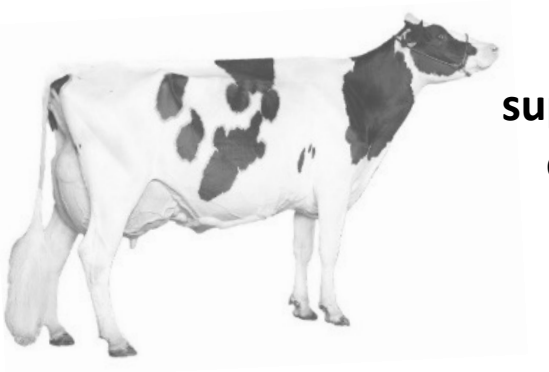


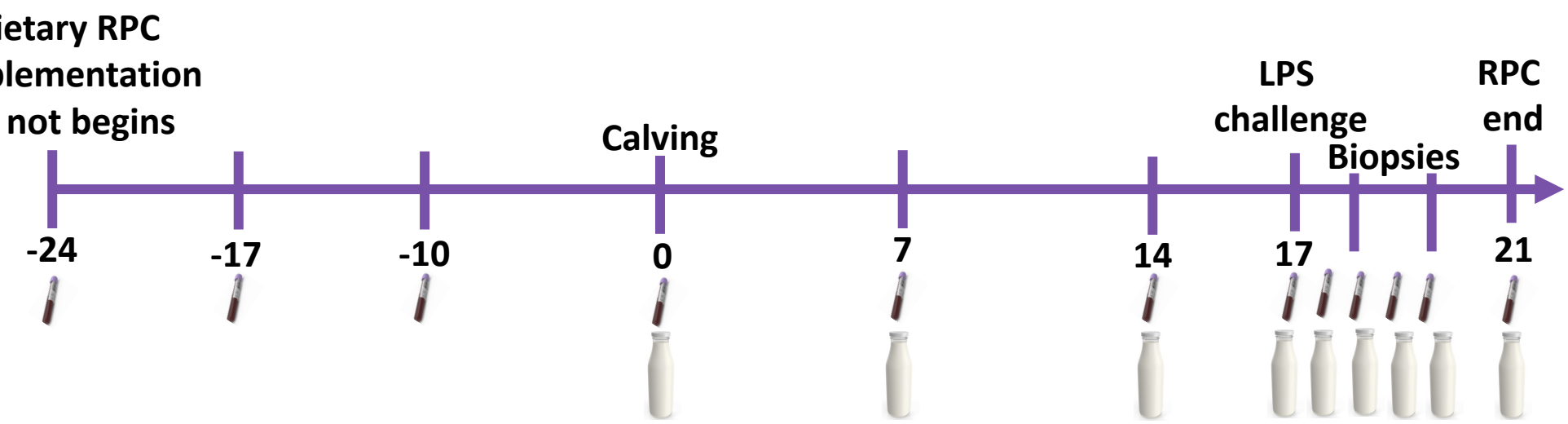
Artegoitia et a., 2014

Does choline work through improving responses to challenge?

- Multiparous cows randomly assigned to receive one of three treatments: dietary supplementation of rumen-protected choline (RPC) at either 45 (**CHOL45**; 20.4 g/d choline), 30 (**CHOL30**; 13.6 g/d choline), or 0 (**CON**) g/d
- Intramammary LPS challenge at 17 DIM or left unchallenged

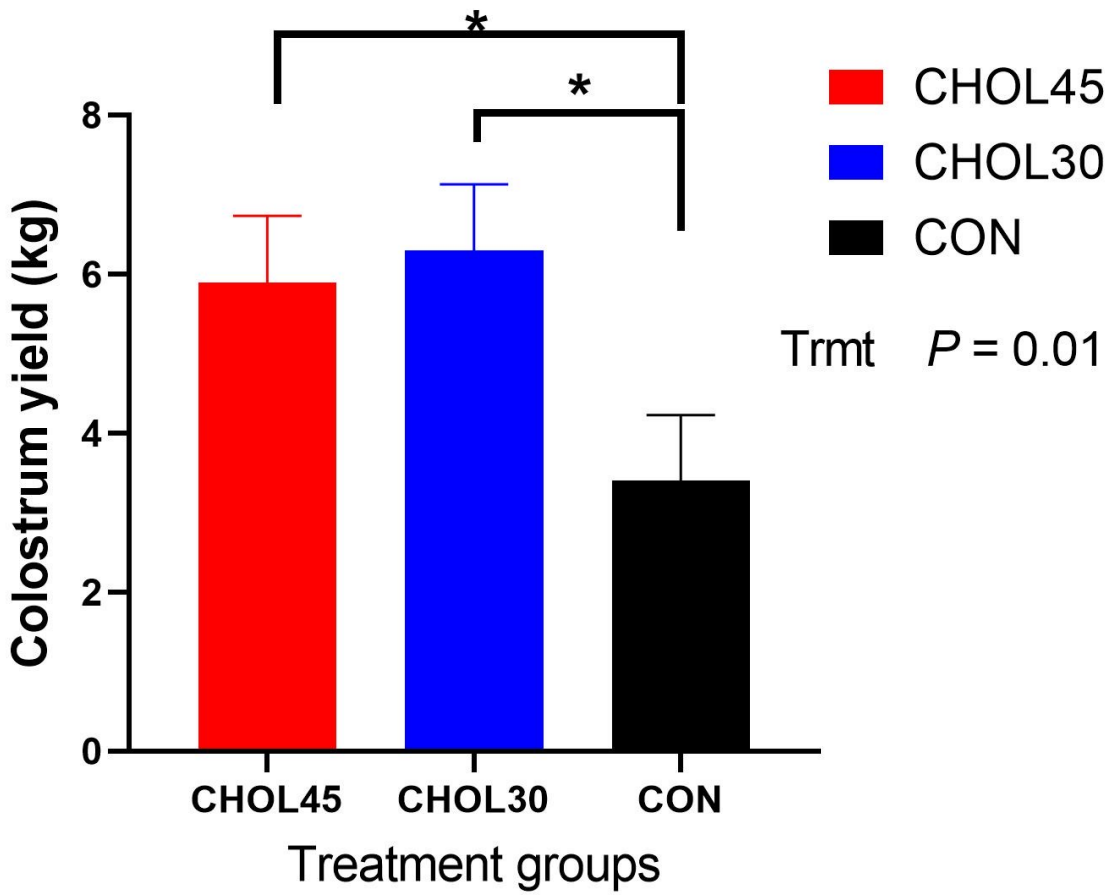
Transition cow study





Swartz et al., 2022 and unpublished data

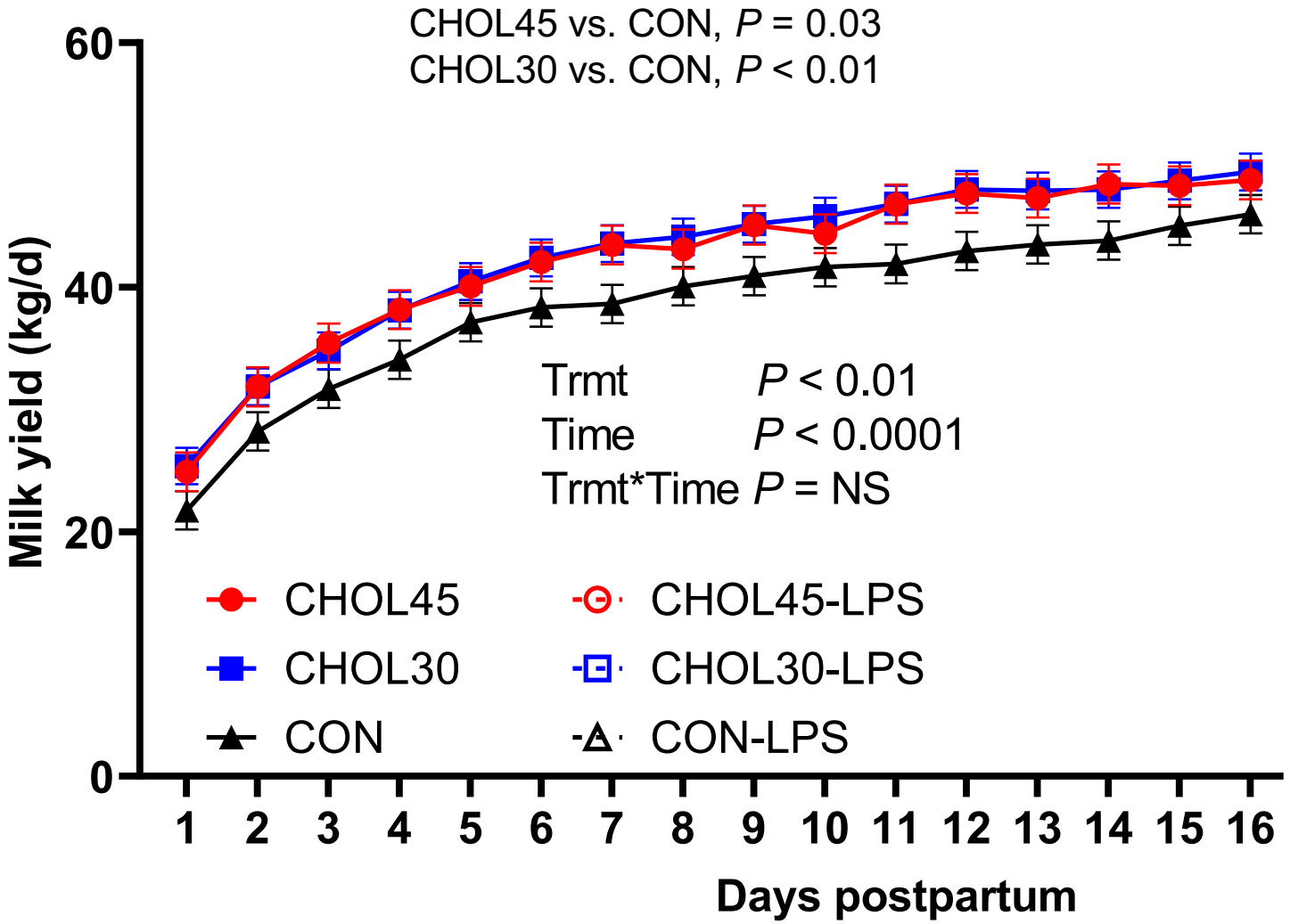
Dietary choline (CHOL) supplementation increased colostrum yield



- CHOL45 and CHOL30 increased colostrum protein yield relative to CON.
- CHOL30 increased colostrum fat yield relative to CON.
- IgG content as assessed by Brix refractometry was not affected by treatment.

Swartz et al., 2022

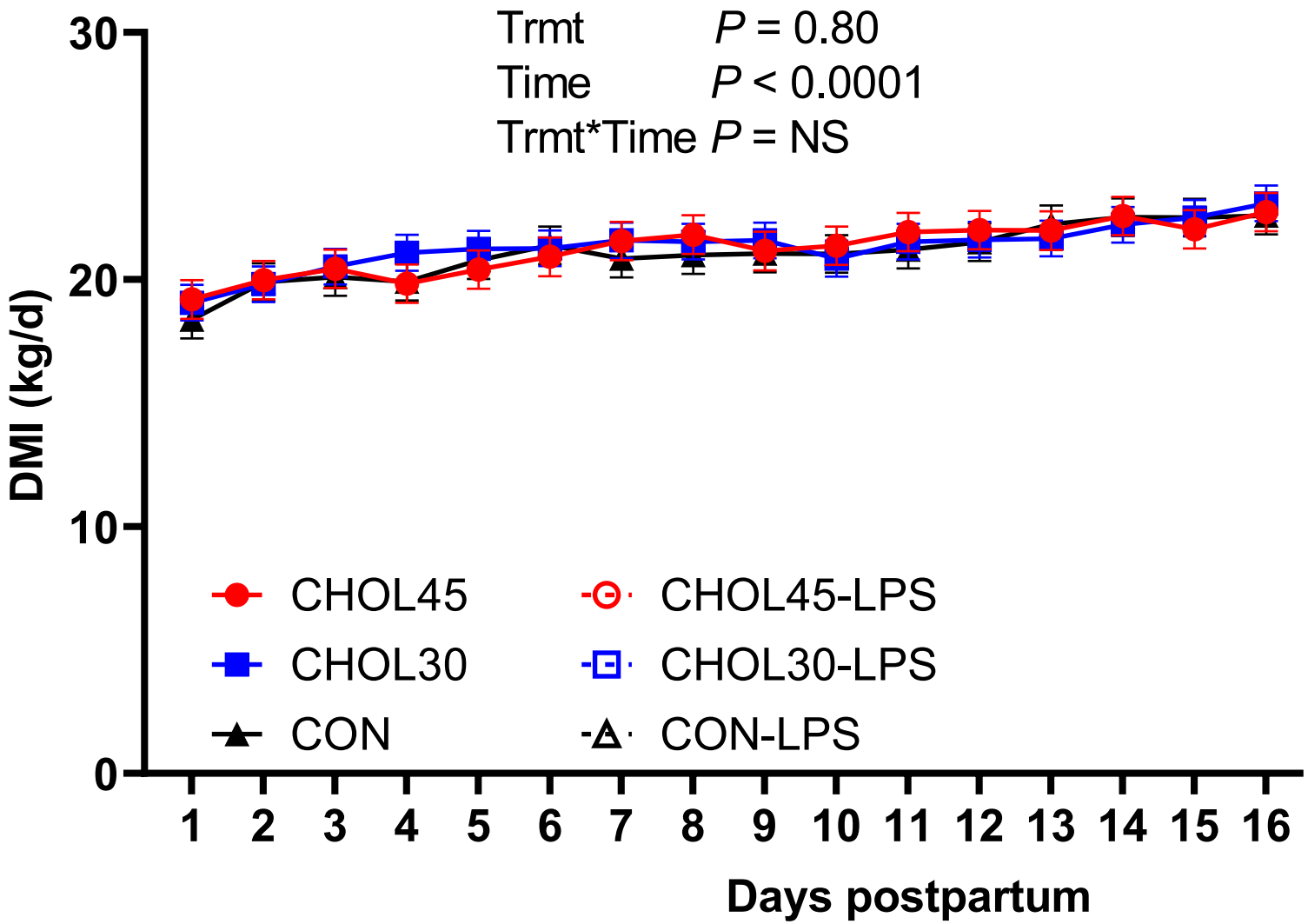
Dietary choline (CHOL) supplementation increased milk yield



+9 lb / day

Swartz et al., *In preparation*

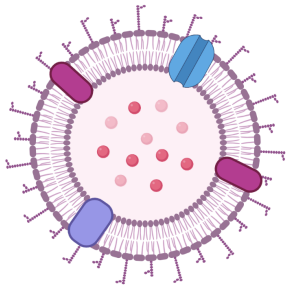
No choline effect on dry matter intake



Swartz et al., *In preparation*

LPS – inflammatory response

Gram-negative
E. coli



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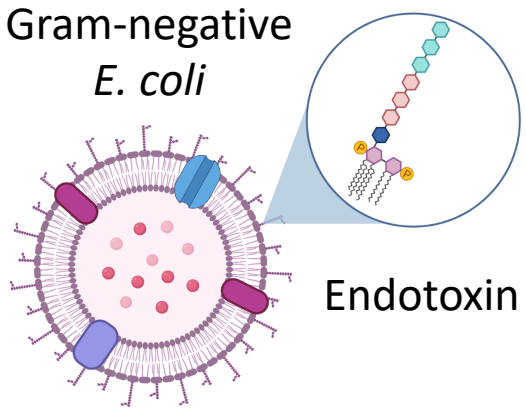

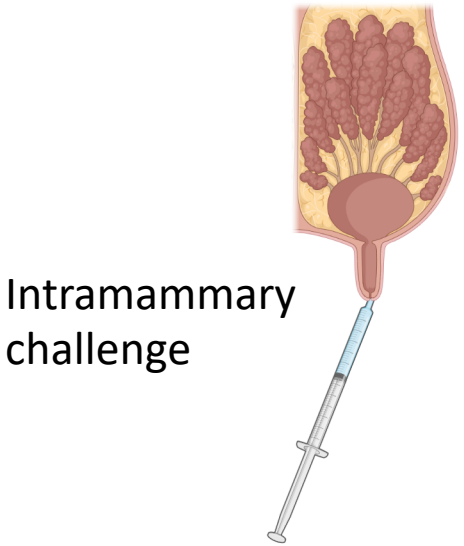

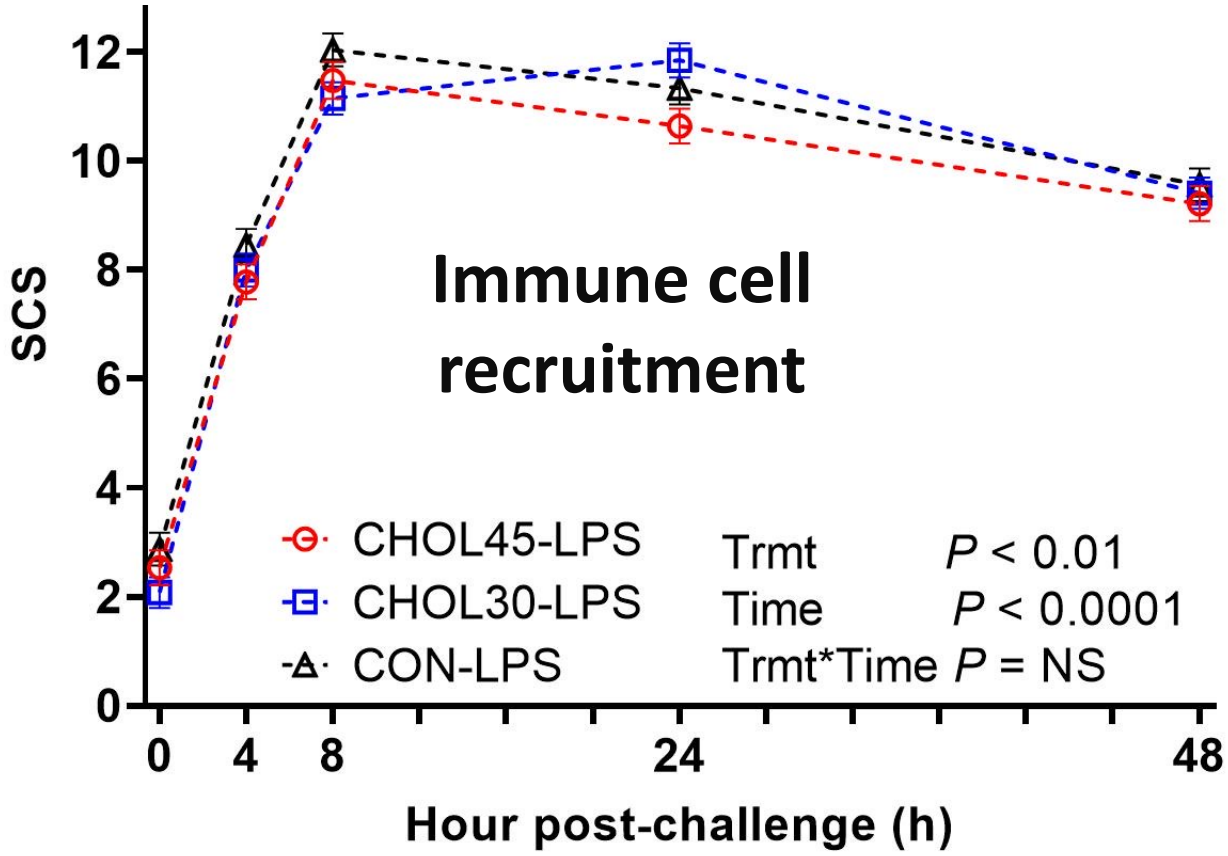

Swartz et al., *In preparation*

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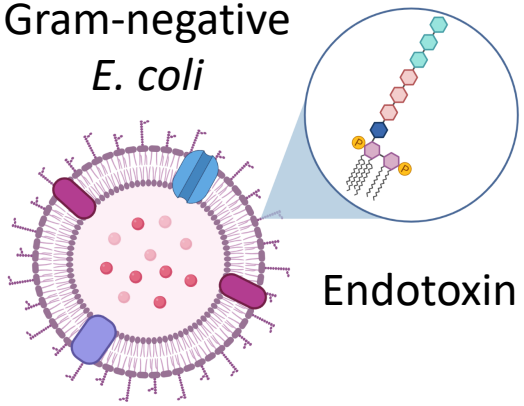
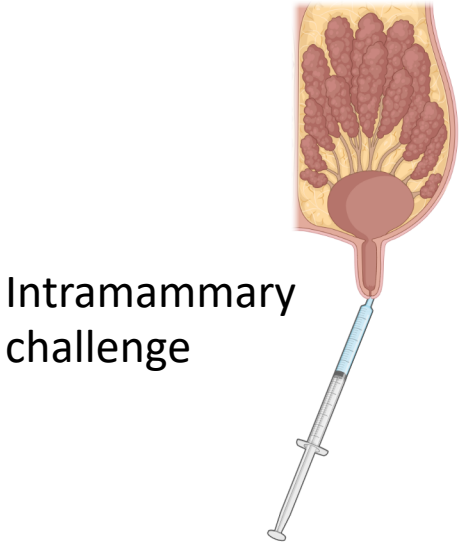
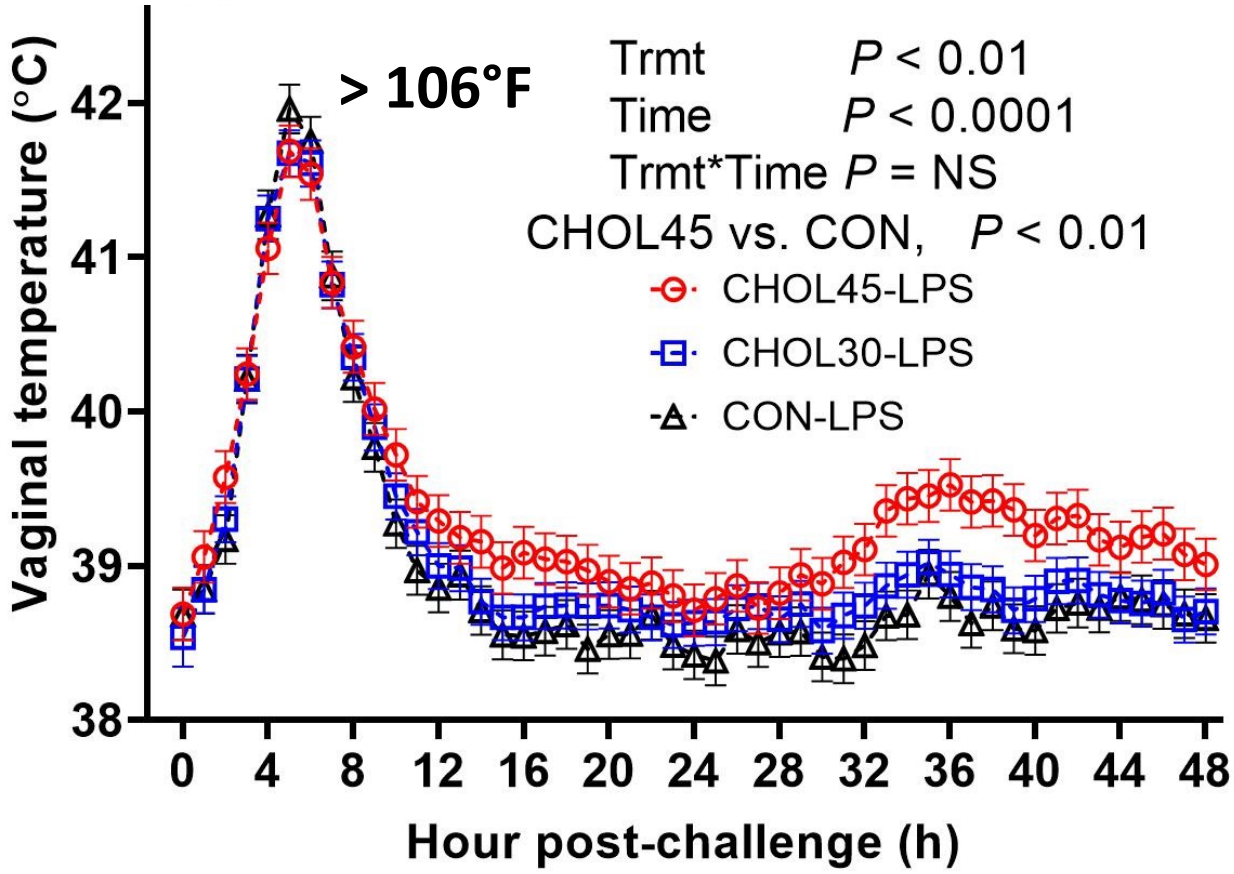


Endotoxin



Intramammary challenge

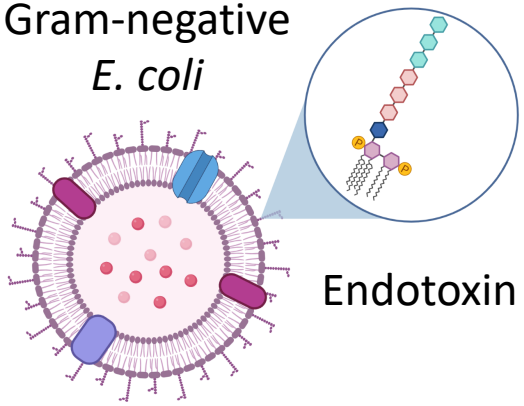
Fever



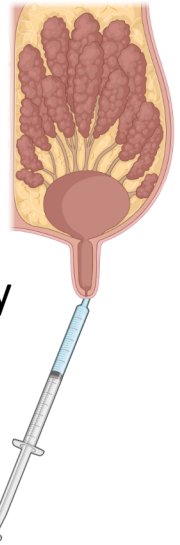
Swartz et al., *In preparation*

LPS – inflammatory response

Gram-negative
E. coli

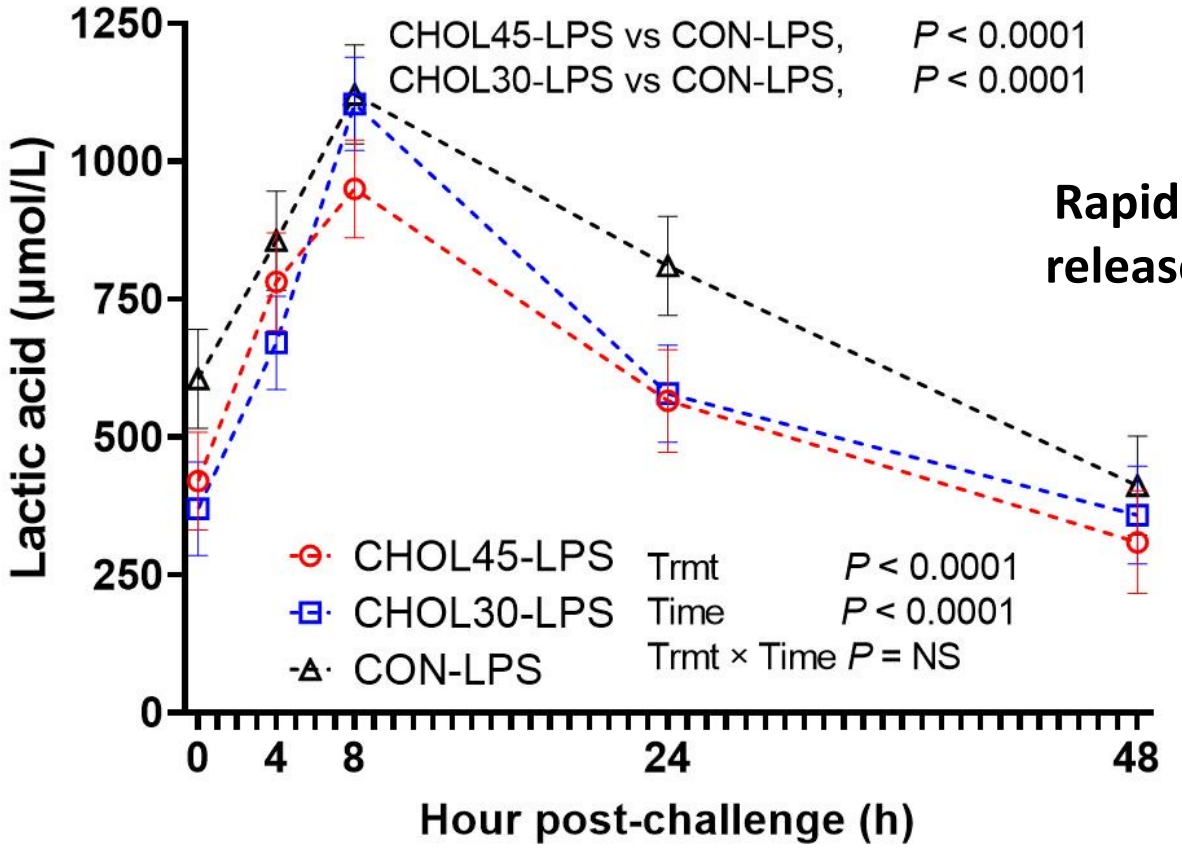


Endotoxin



Intramammary challenge

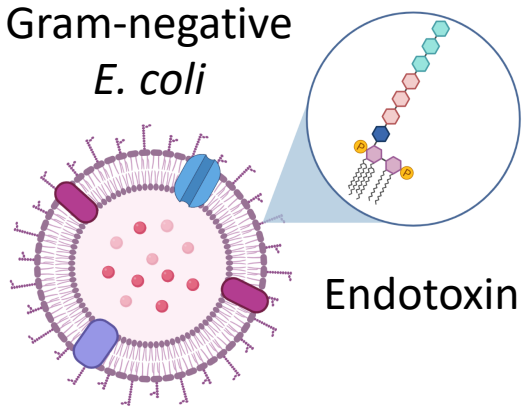
Metabolic disruptions

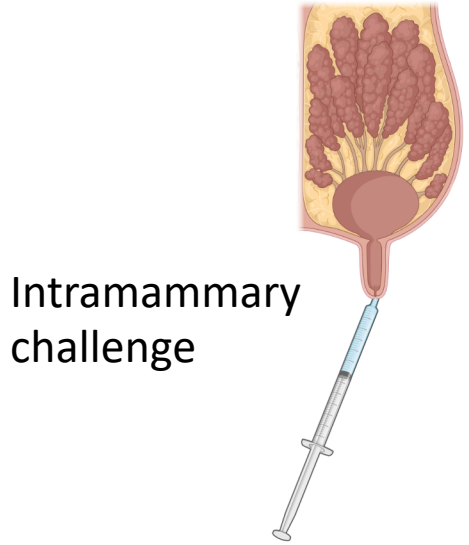


Rapid glucose use releases lactic acid

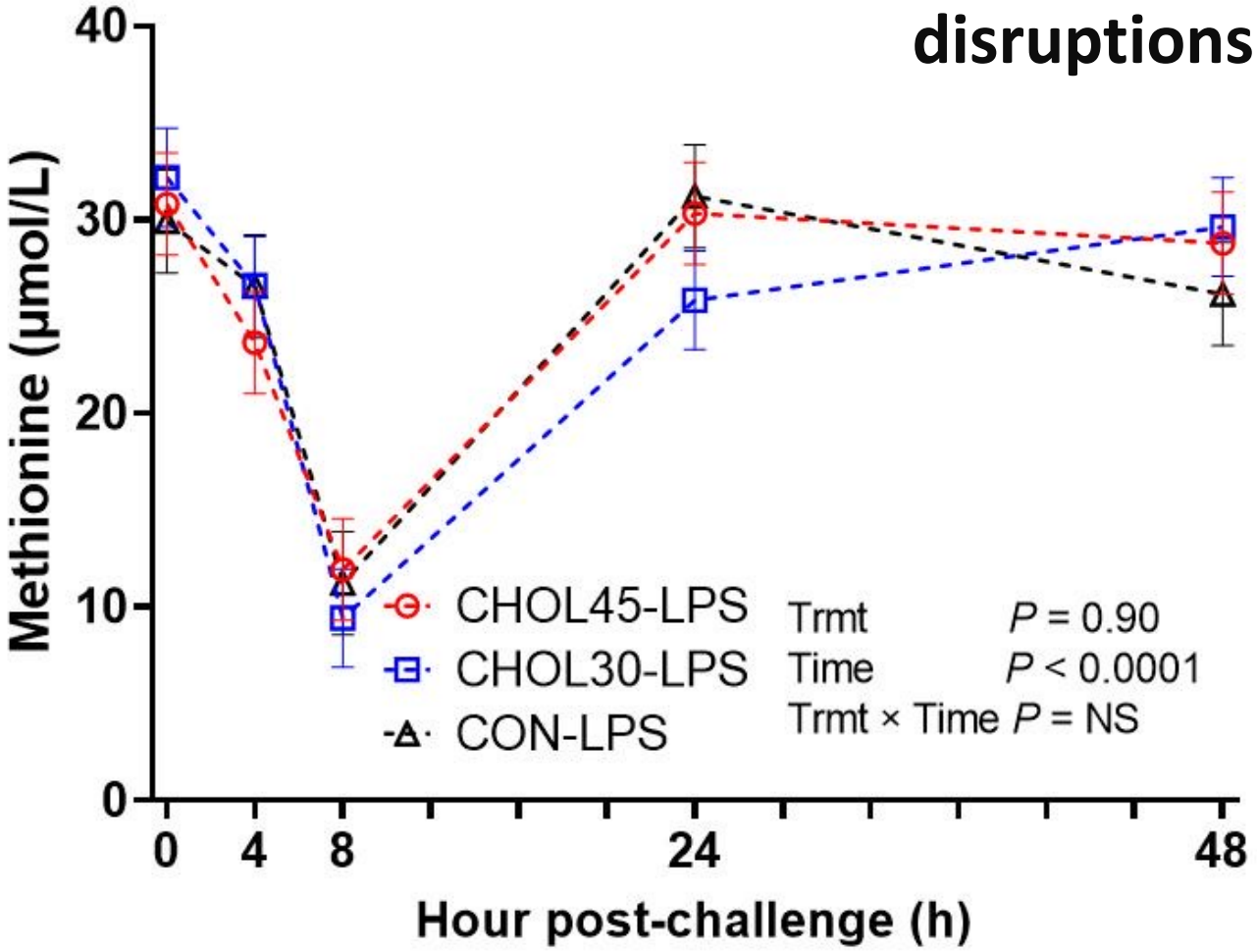
Swartz et al., *In preparation*

LPS – inflammatory response



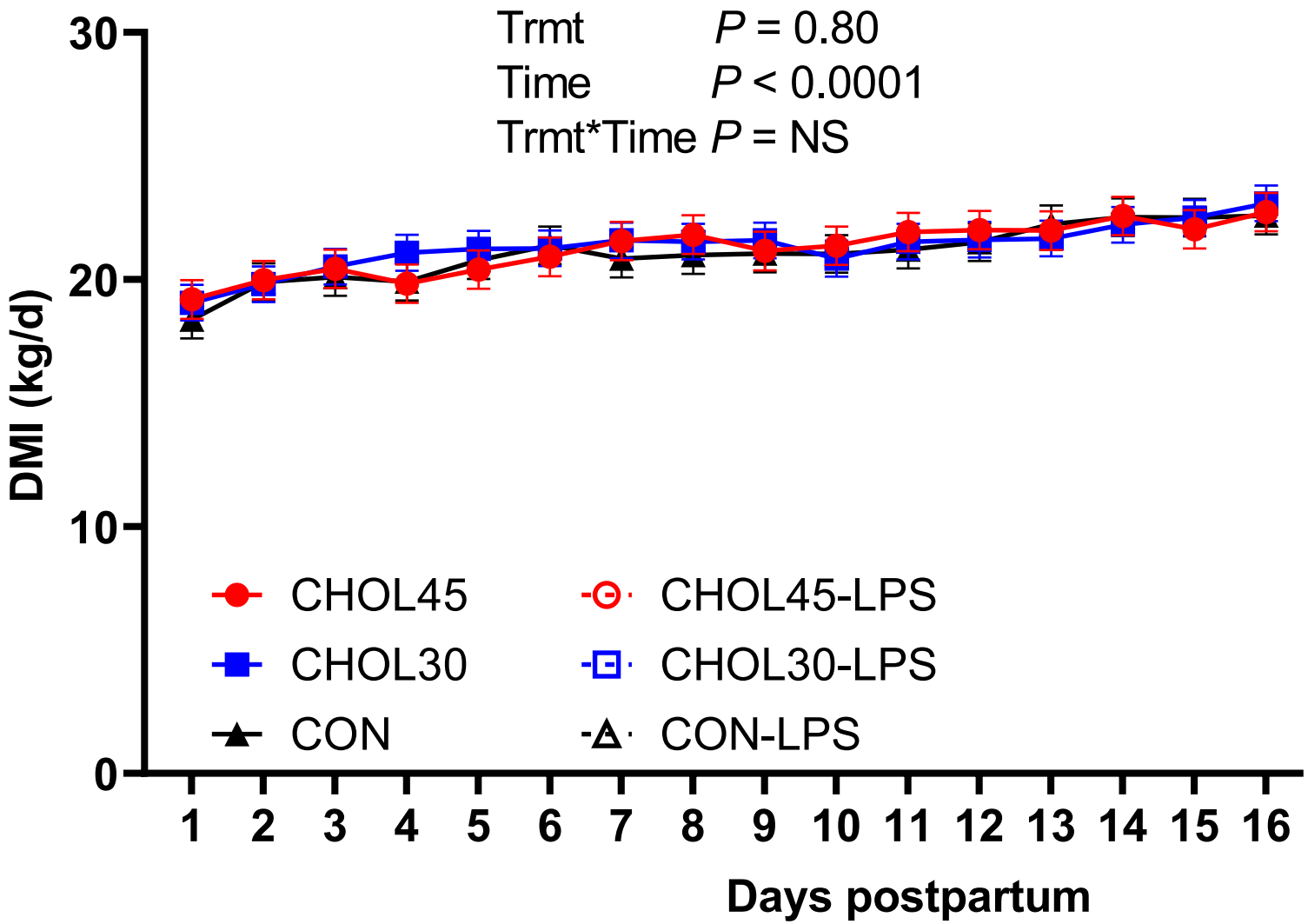


Metabolic disruptions



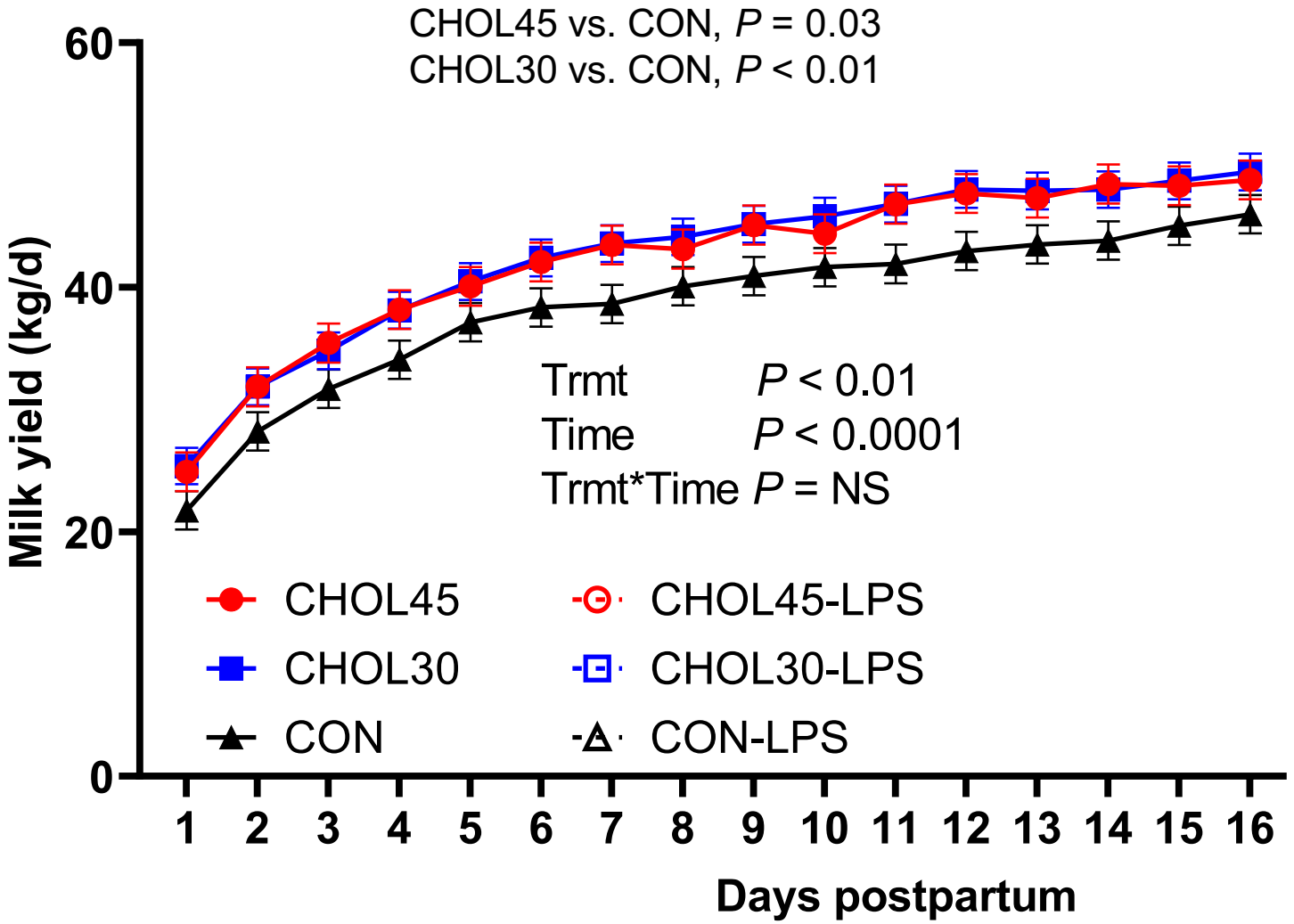
Swartz et al., *In preparation*

Dry matter intake through challenge



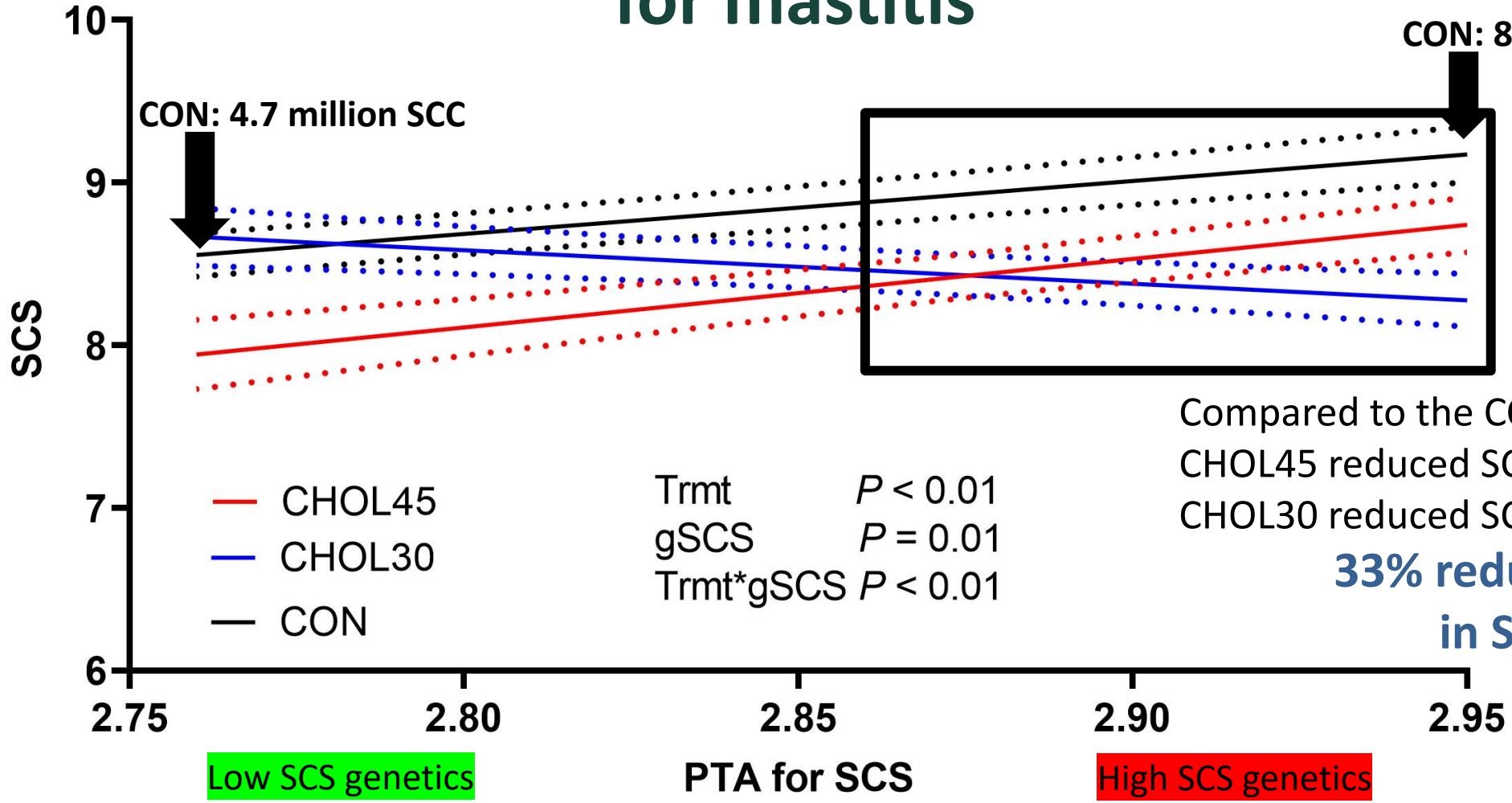
Swartz et al., *In preparation*

Milk yield response to challenge



Swartz et al., *In preparation*

LPS challenge – RPC interacted with the genetic propensity for mastitis

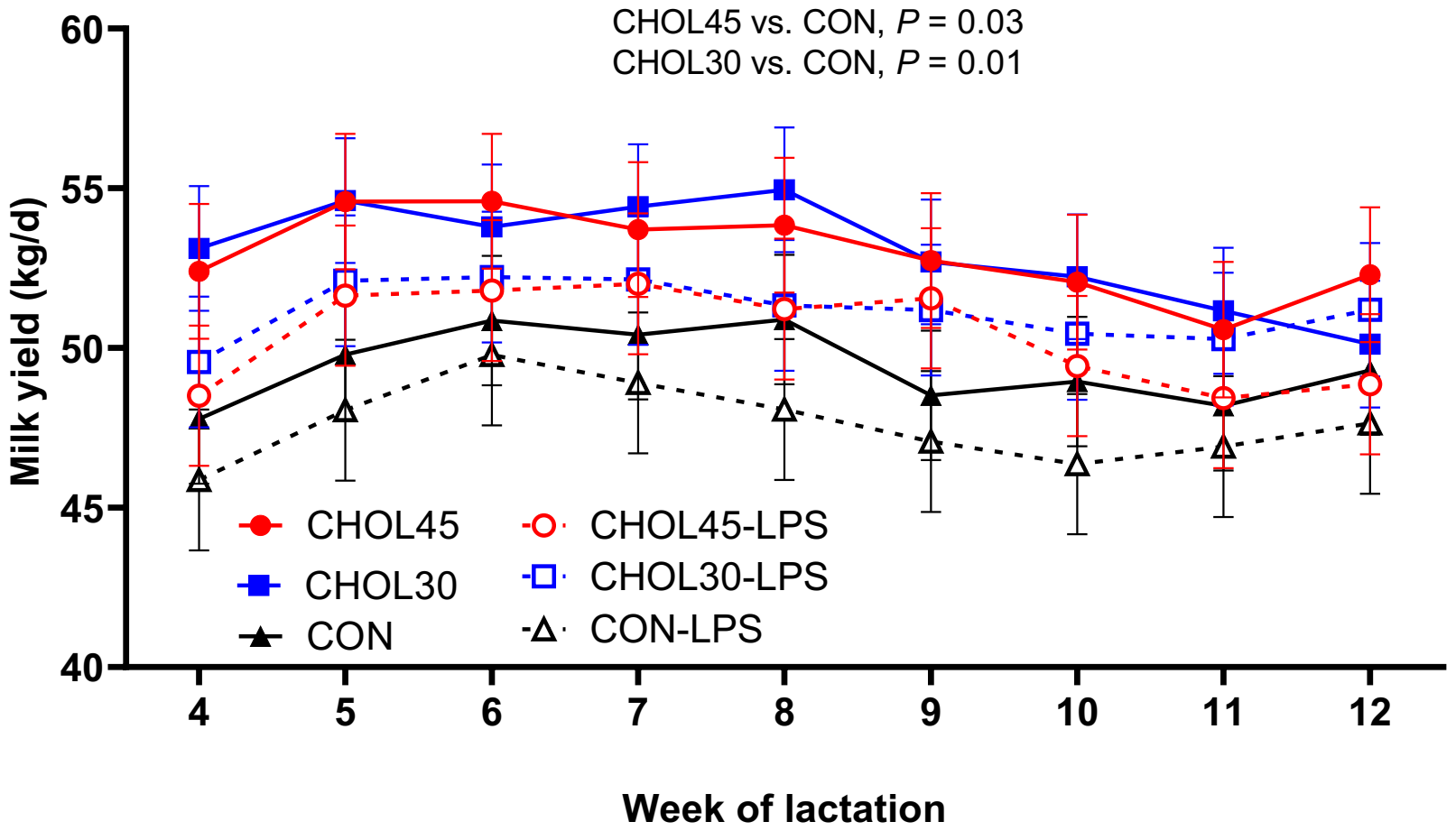


Compared to the CON:
CHOL45 reduced SCC by 1.8 million
CHOL30 reduced SCC by 2.5 million

33% reduction in SCC

Swartz et al., *In preparation*

Dietary CHOL supplementation increased milk yield in the carry-over period (22-84 DIM) by ~ 10 lb/day

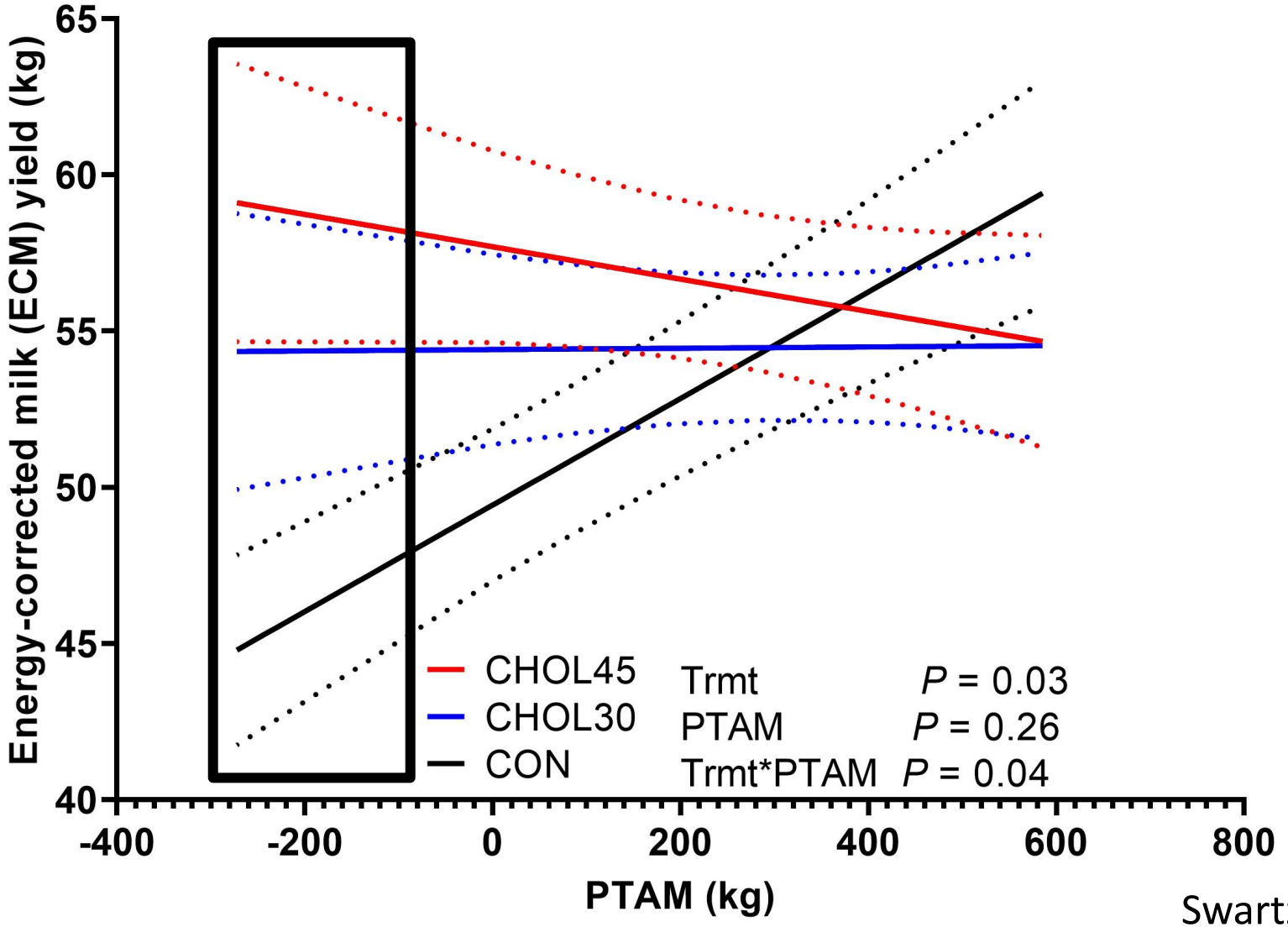


Trmt	*P* = 0.02
LPS	*P* = 0.05
Trmt*LPS	*P* = NS

LPS "hangover" of about 5 lb/d for at least 2 months post-challenge

Swartz et al., *In preparation*

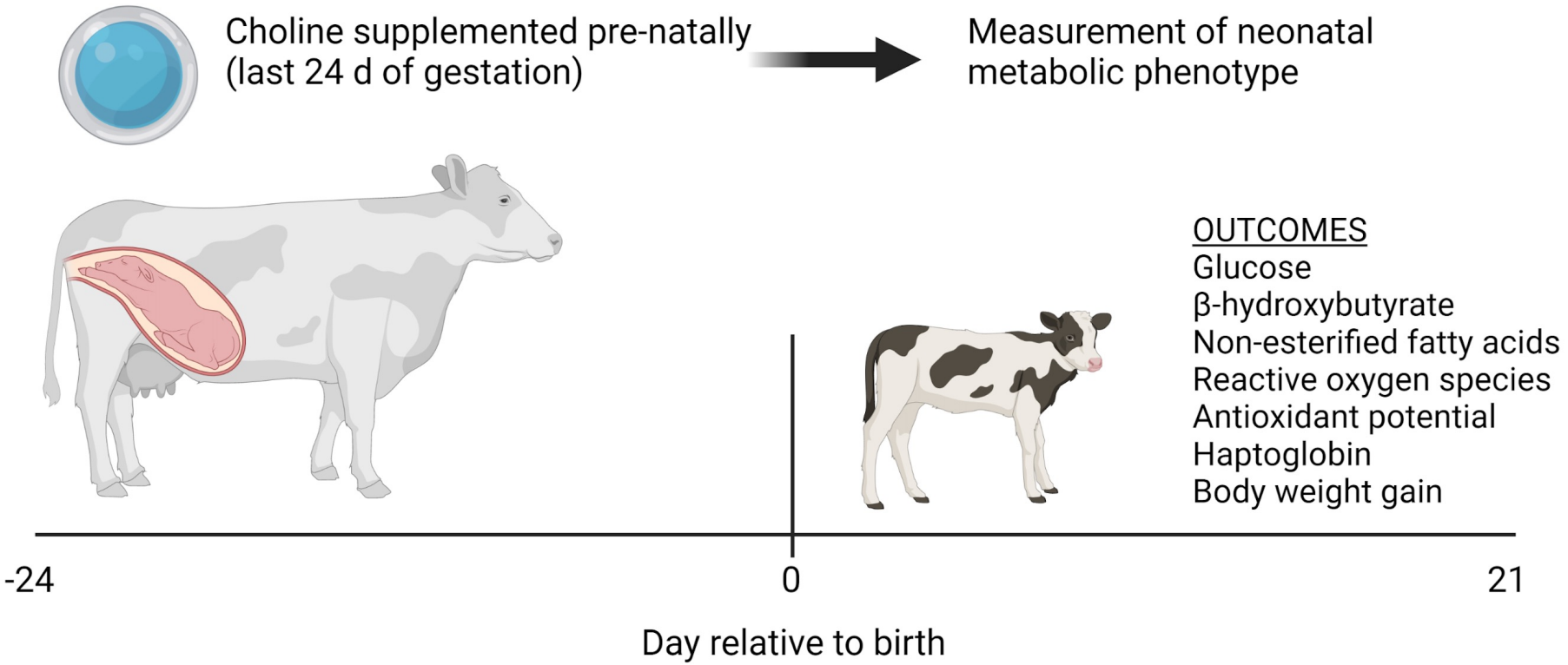
Choline increased ECM yields in less elite cows



Swartz et al., *In preparation*

What about the calves??

- Key factor: all calves fed commercial colostrum replacer, NOT dam's colostrum



What about the calves??

J. Dairy Sci. 105:9639–9651
https://doi.org/10.3168/jds.2022-22239

Effects of prenatal dietary rumen-protected choline supplementation during late gestation on calf growth, metabolism, and vaccine response

T. H. Swartz,[1]* B. J. Bradford,[1] M. Lemke,[1] L. K. Mamedova,[1] R. Agnew,[1] J. Fehn,[1] E. Owczarzak,[1] J. L. McGill,[2] and K. A. Estes[3]
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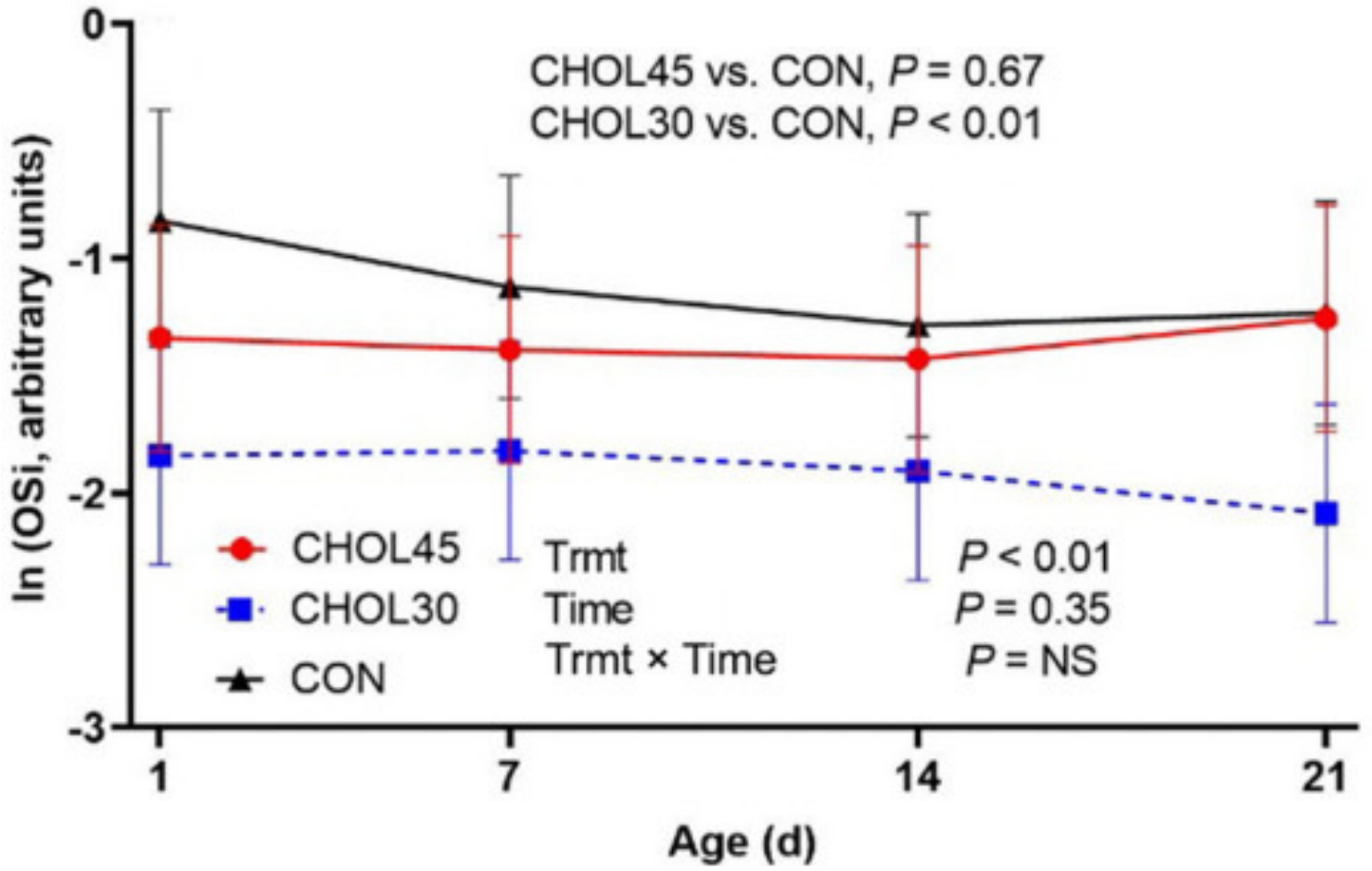
[2]Department of Veterinary Microbiology and Preventive Medicine, Iowa State University, Ames 50011
[3]Balchem Corporation, New Hampton, NY 10958

ABSTRACT

The objective of this study was to examine the effects of prenatal supplementation and dose of rumen-protected choline (RPC) on neonatal calf growth, metabolism, and vaccine response. Parous Holstein cows were blocked by calving month and randomly assigned

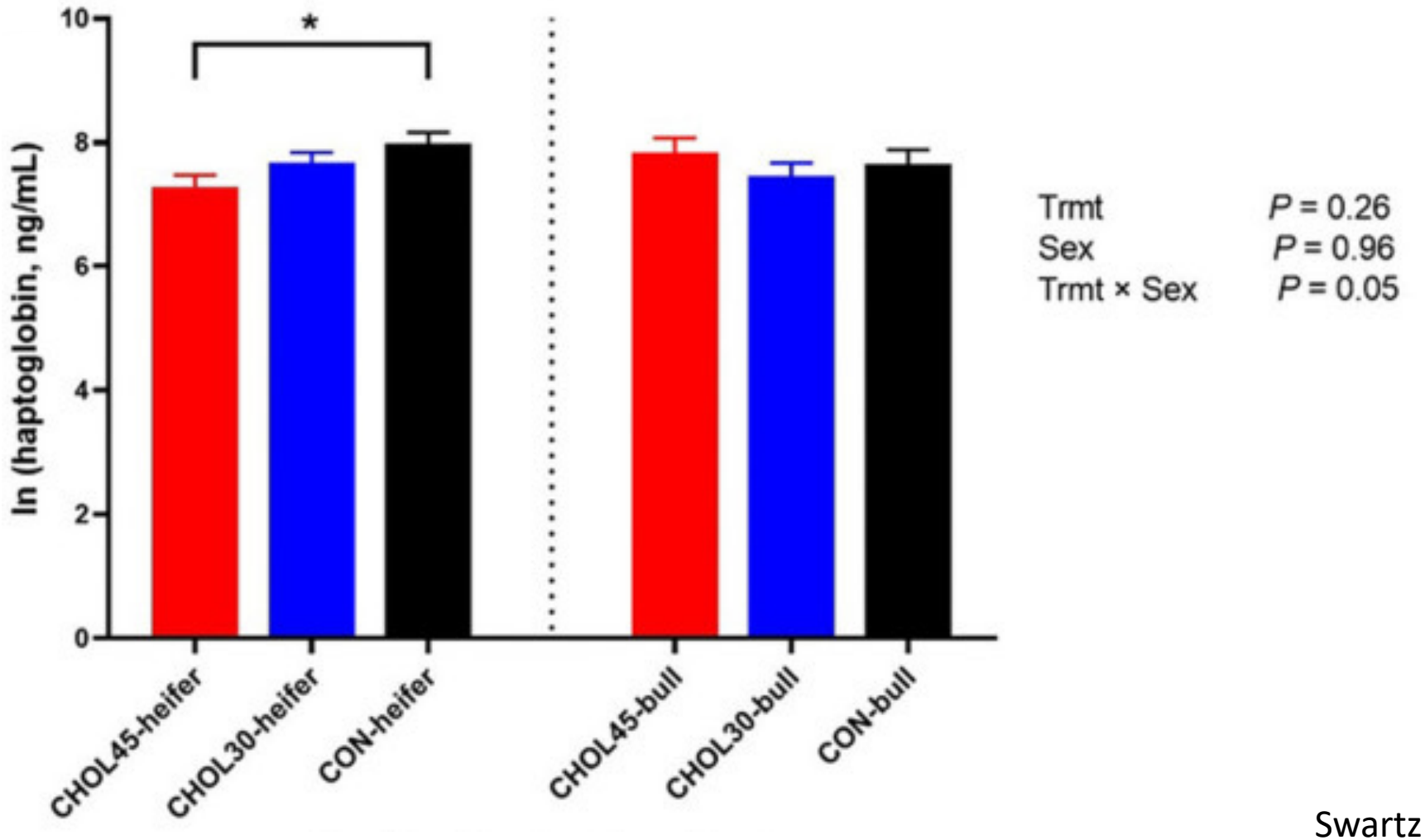
dam's prepartum NEFA concentration interacted with treatment. When dam NEFA was minimal, calves from CHOL45 and CHOL30 dams had greater or tended to have greater NEFA, respectively. Conversely, when dam NEFA was greater, calves from CHOL30 and CHOL45 dams had lesser or tended to have lesser NEFA than

Reduced oxidative stress index in CHOL30 calves



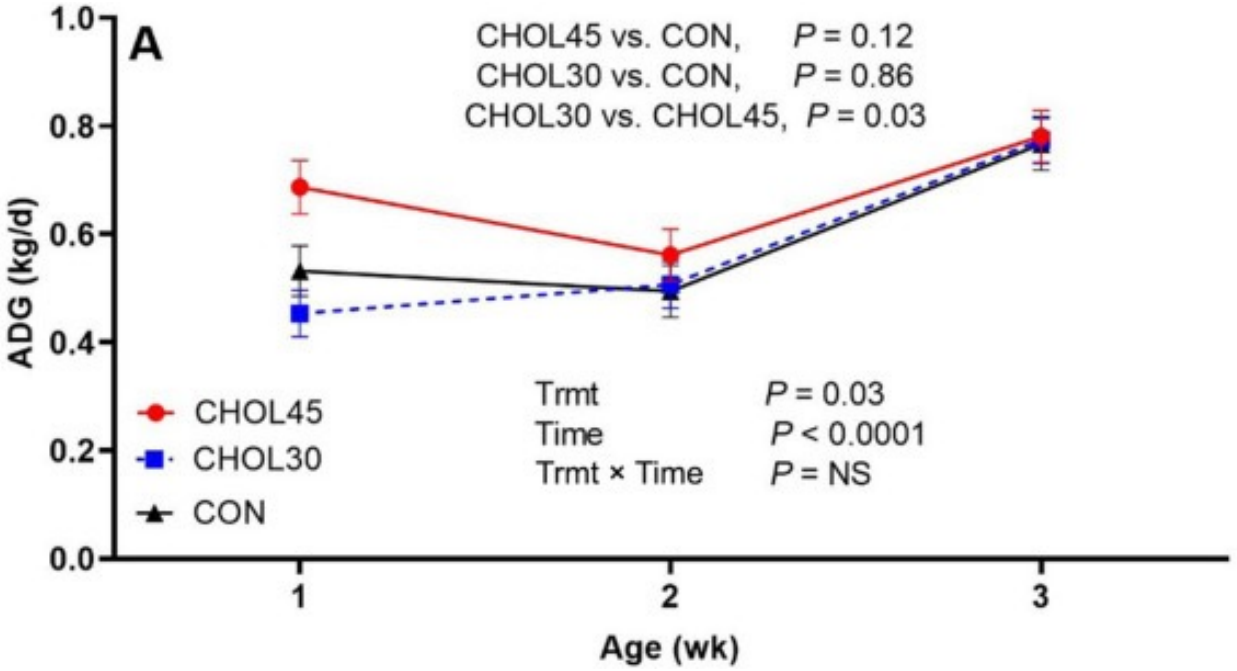
Swartz et al., 2022

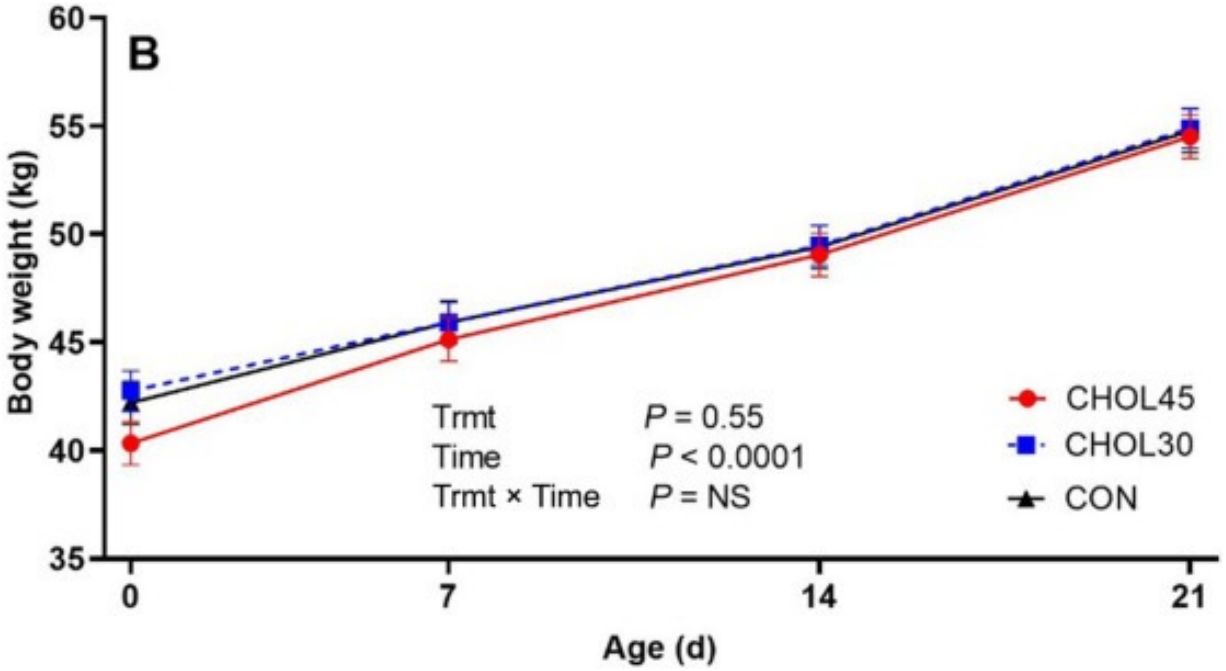
Reduced marker of inflammation in CHOL45 heifers



Swartz et al., 2022

Minimal effects on growth through day 21





Swartz et al., 2022

Highlights from MSU transition choline study

- 80% increase in colostrum yield is surprising and worth exploring
- Choline increased milk & ECM yield by ~10 lb/day, but not by diminishing the hit from LPS
- Genetic interactions raise interesting questions about precision feeding
- This study is the first to demonstrate in a randomized design that early lactation intramammary LPS substantially reduces peak milk yield (5+ lb/d)
- Some hints of improved oxidative balance and inflammatory status in calves exposed in utero, but no apparent effects on growth

How do we get the next 5 pounds of milk?

1. **Refine feeding strategies to better meet metabolic needs and equip the mammary gland with the necessary nutrients for milk.**

2. **Prevent the clinical + subclinical transition cow problems that impact productivity of 20-40% of our cows. (3 lb/d x 30%)**

3. Reduce culling to increase average productive life and decrease the fraction of first-lactation cows in our herds

Thank you!

Questions/comments:

Barry Bradford

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