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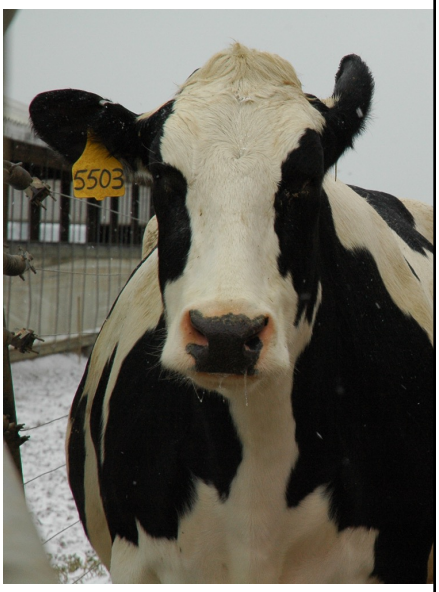
How do we get the next 2 kg of milk?



Barry Bradford

Michigan State University

1

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How do we get the next 2 kg 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. (2 kg/d x 30%)

2

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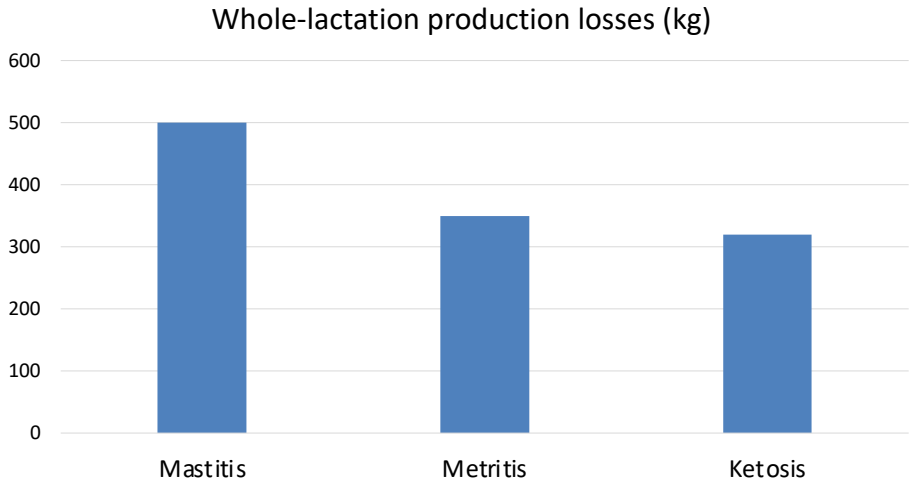
Long-term consequences of transition problems



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

3

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How do we get the next 2 kg of milk?

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4

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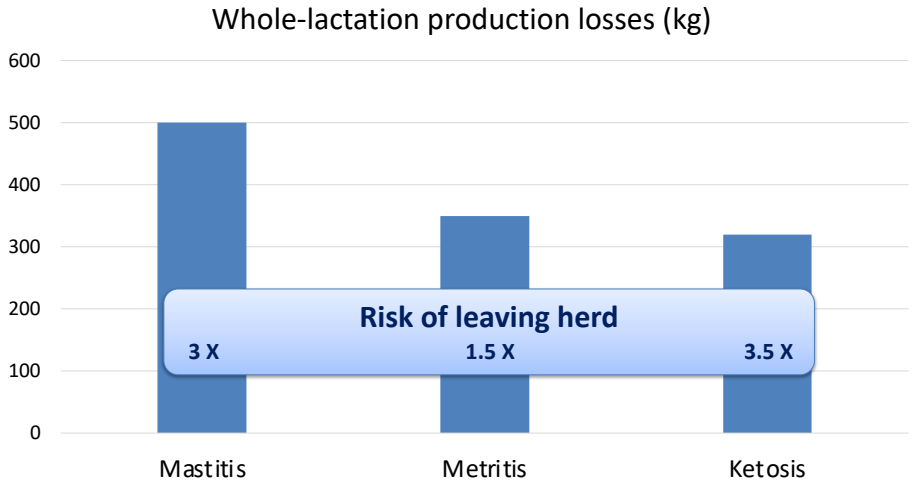
Long-term consequences of transition problems



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

5

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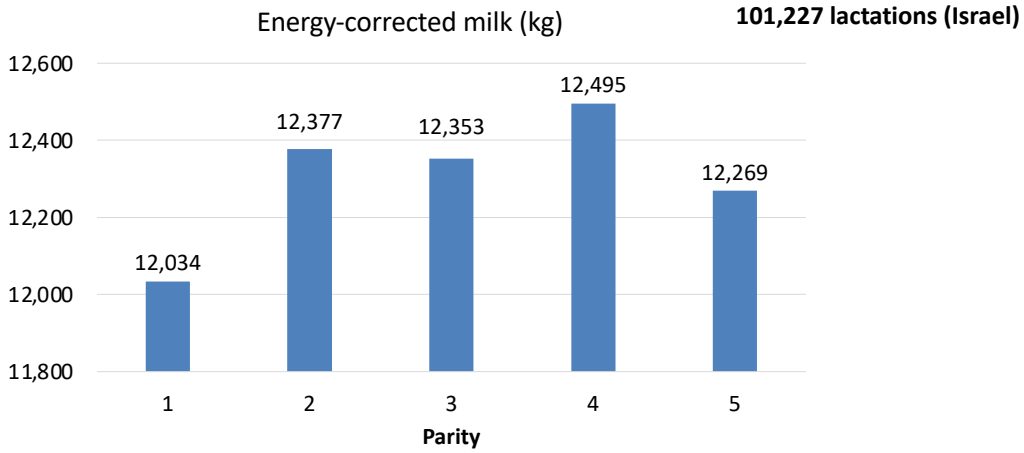
Productivity & profitability increase until lactation 4-5



Courtesy of Zachut, Ezra, and Lavon; 2021 data

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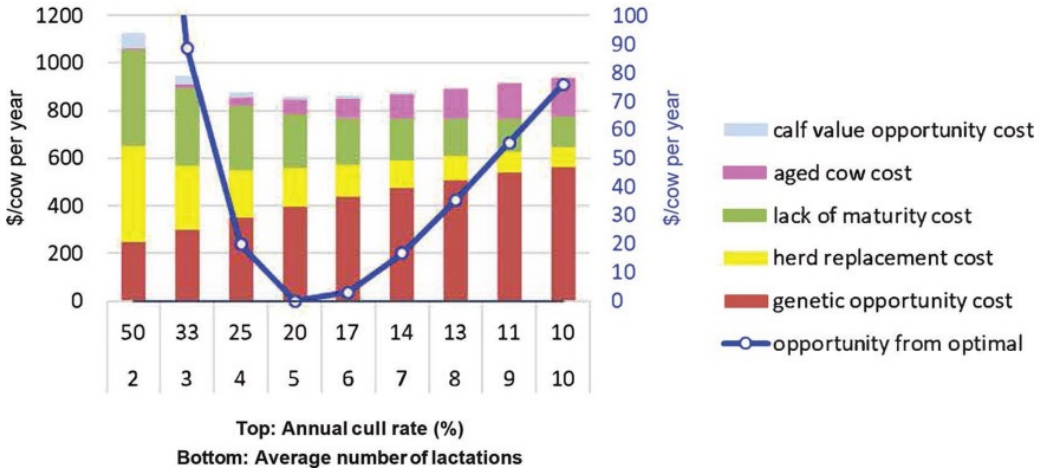
Productivity & profitability increase until lactation 4-5

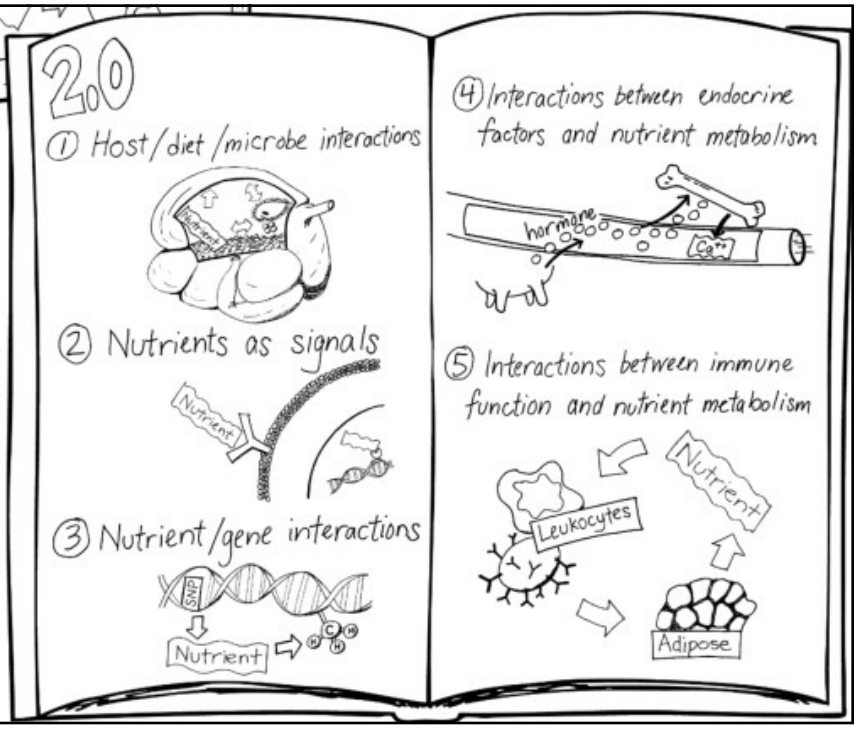


Top: Annual cull rate (%)
Bottom: Average number of lactations

De Vries, 2020

7

How to go about improving health and longevity?



Bradford et al., 2016

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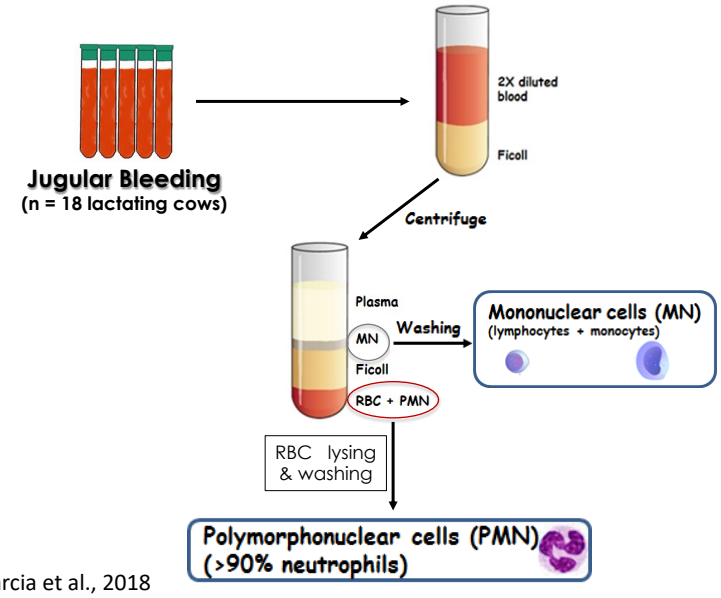
Choline can affect immune cells

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



Garcia et al., 2018

9

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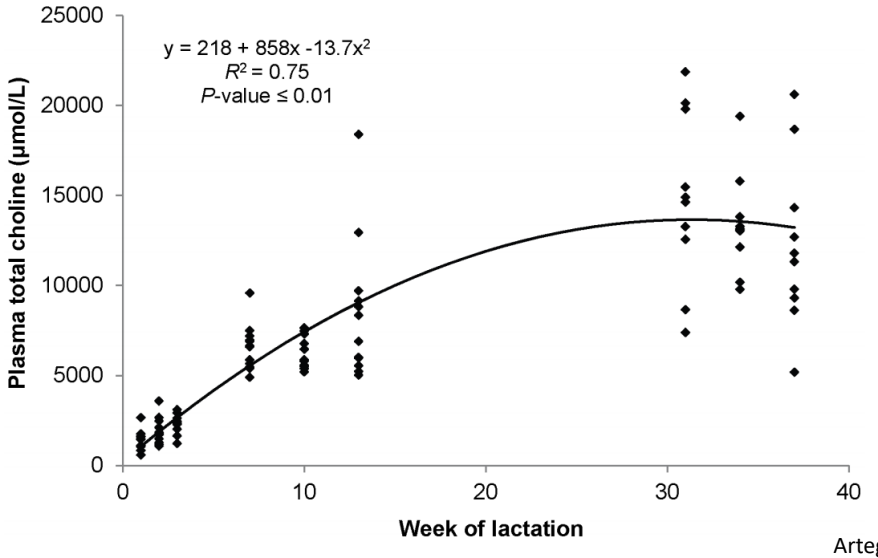
Choline in lactating cows



Artegoitia et a., 2014

10

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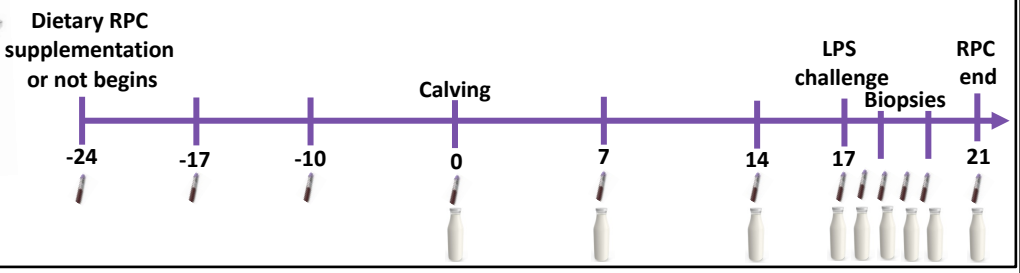
Does choline work through improving responses to challenge?

- Multiparous cows randomly assigned to receive one of three treatments: dietary supplementation of **ReaShure-XC** 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 days in milk or left unchallenged

Transition cow study



Swartz et al., 2022 and unpublished data

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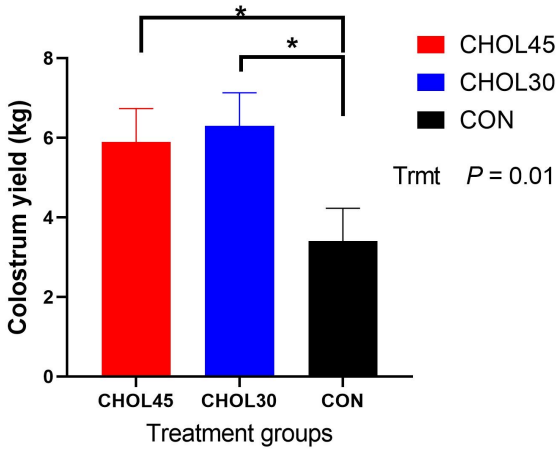
Dietary choline (CHOL) supplementation increased colostrum yield



- 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

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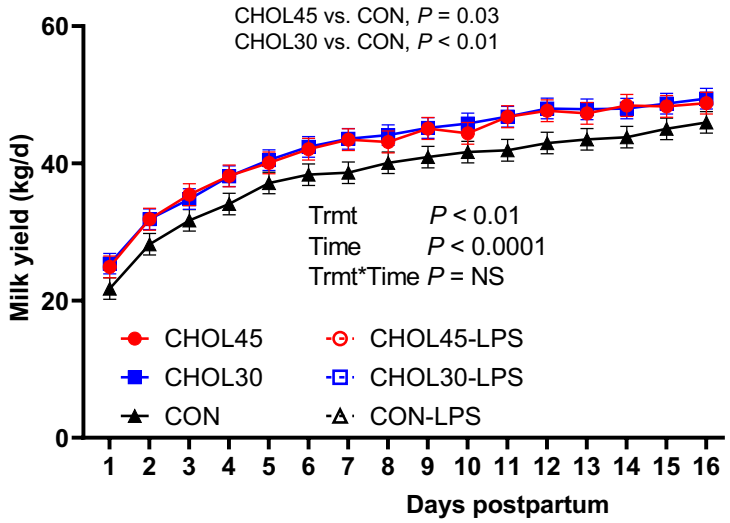
Dietary choline (CHOL) supplementation increased milk yield



+4 kg/ day

Swartz et al., *accepted*

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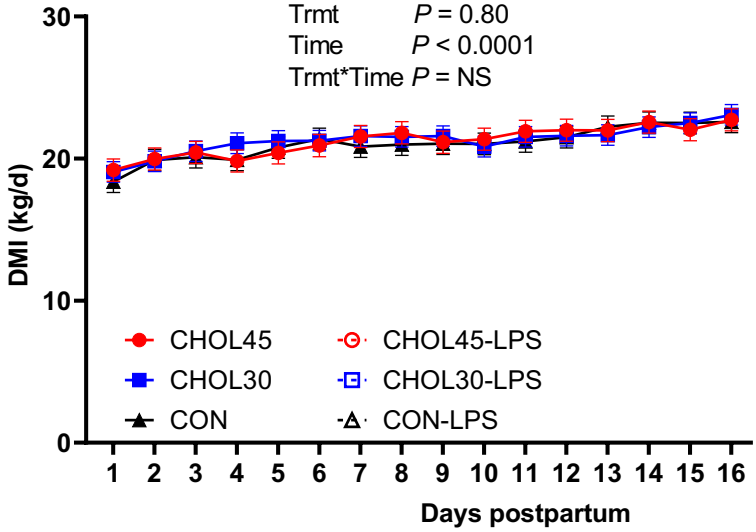
No choline effect on dry matter intake



Swartz et al., *accepted*

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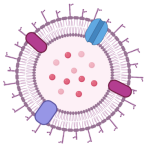
LPS – inflammatory response

Gram-negative
E. coli



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LPS – inflammatory response

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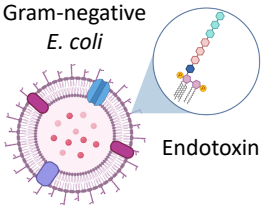
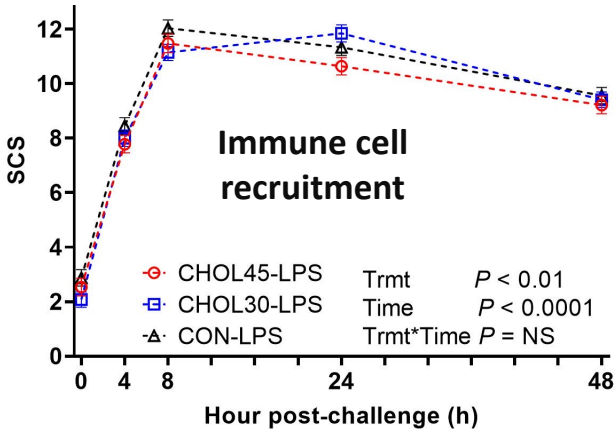


Endotoxin

Intramammary
challenge



Swartz et al., *accepted*

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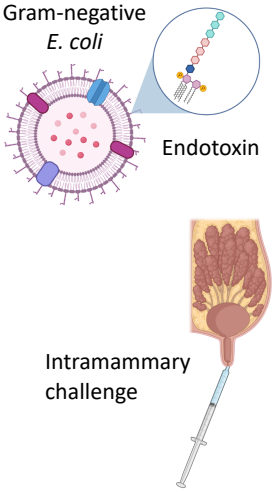
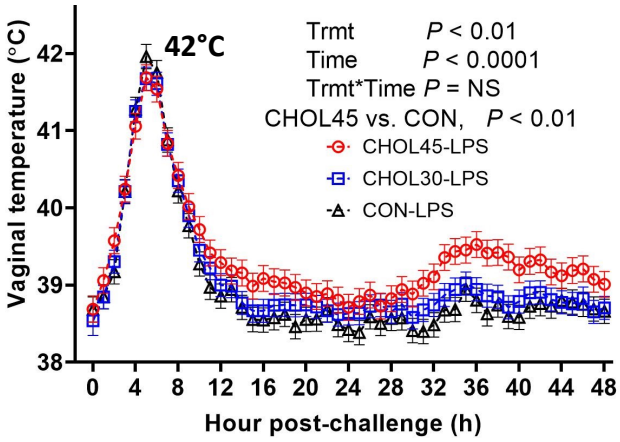
LPS – inflammatory response

Fever





Swartz et al., *accepted*

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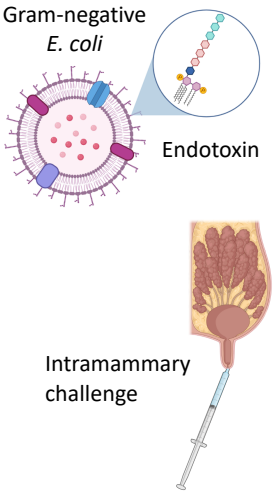
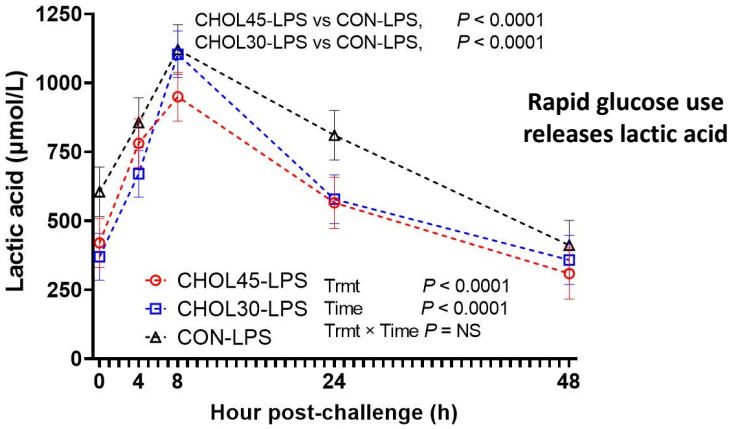
LPS – inflammatory response

Metabolic disruptions





Swartz et al., *accepted*

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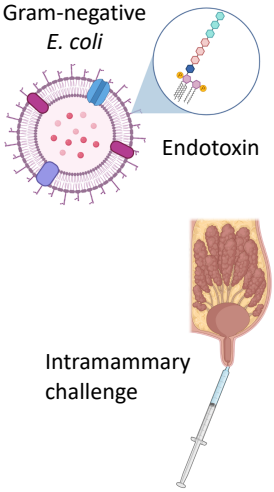
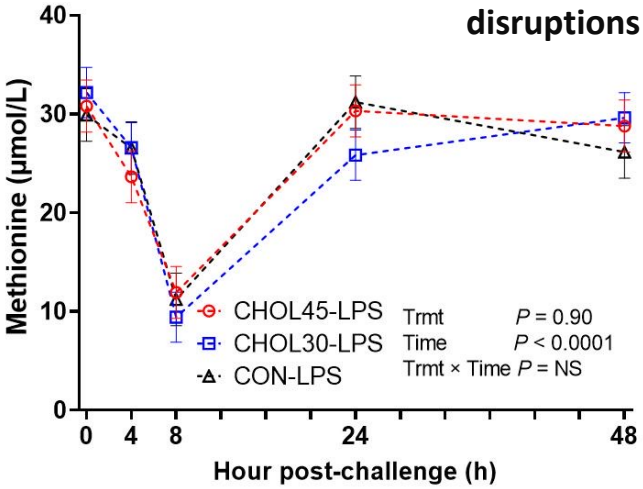
LPS – inflammatory response



Metabolic disruptions



Swartz et al., *accepted*

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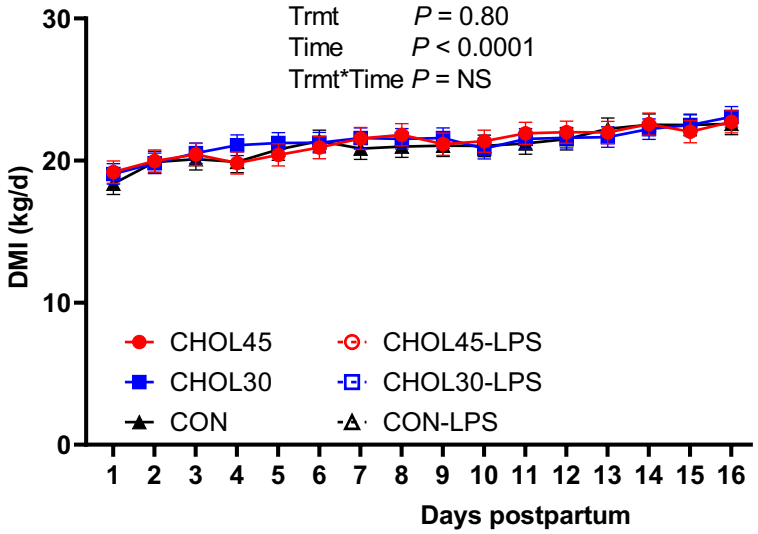
Dry matter intake through challenge



Swartz et al., *accepted*

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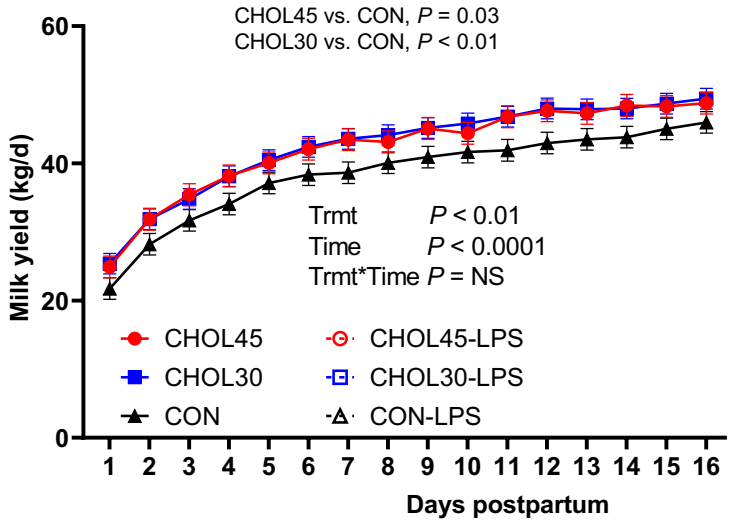
Milk yield response to challenge



Swartz et al., *accepted*

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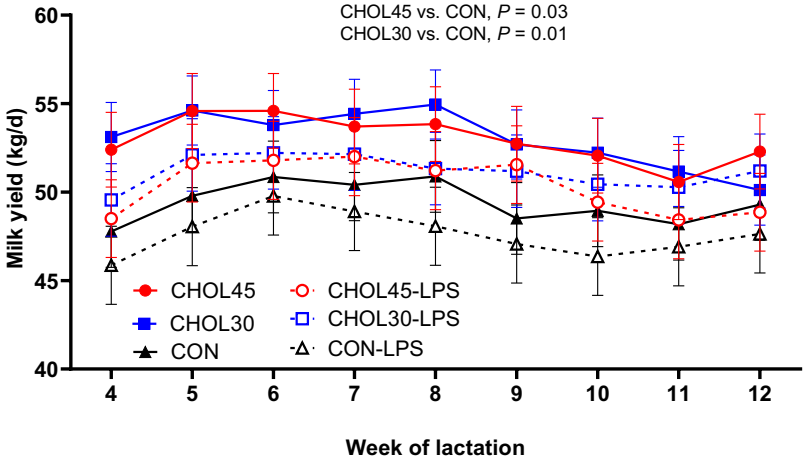
Dietary CHOL supplementation increased milk yield in the carry-over period (22-84 days in milk) by ~ 4 kg/day



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

Swartz et al., *accepted*

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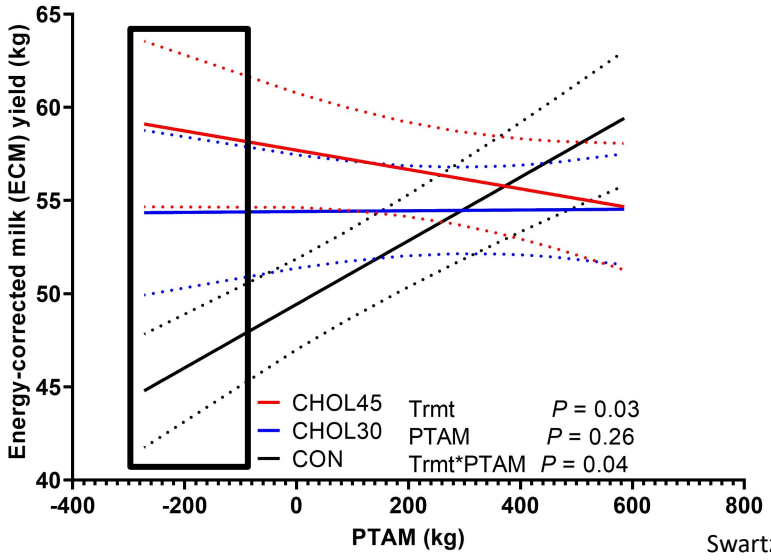
Choline increased ECM yields in less elite cows



Swartz et al., *accepted*

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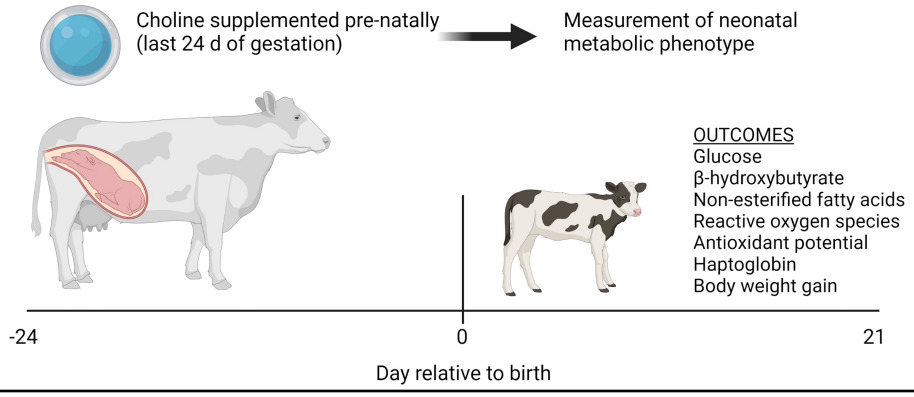
What about the calves??

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



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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]
[1]Department of Animal Science, Michigan State University, East Lansing 48824
[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

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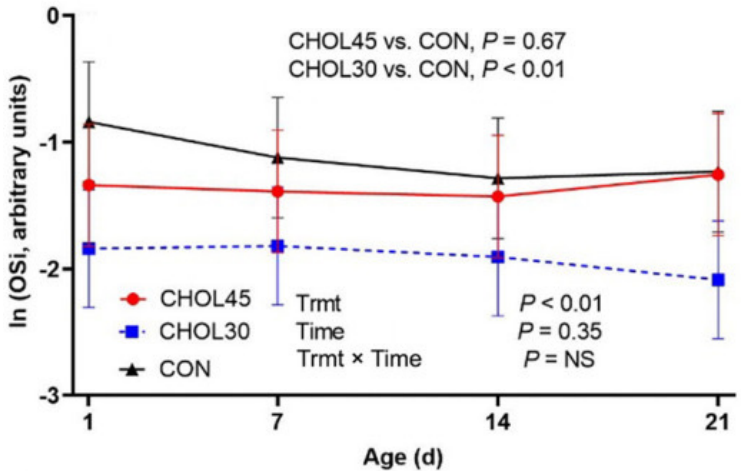
Reduced oxidative stress index in CHOL30 calves



Swartz et al., 2022

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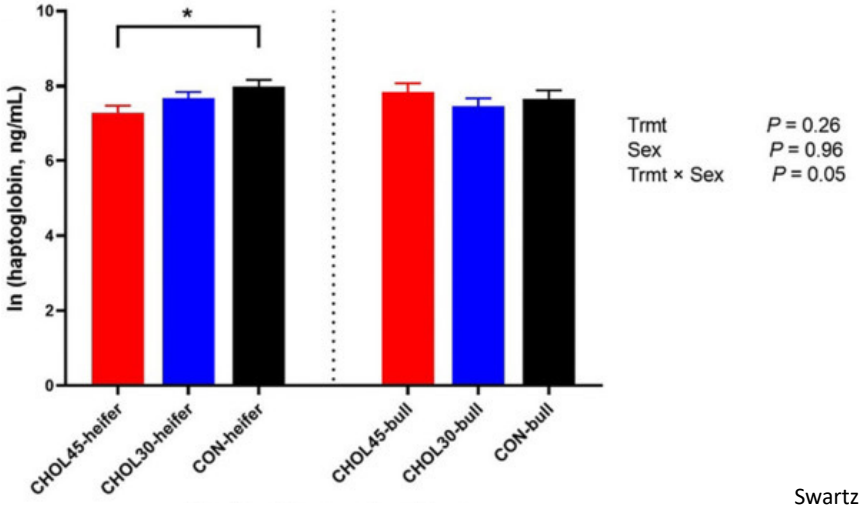
Reduced marker of inflammation in CHOL45 heifers



Swartz et al., 2022

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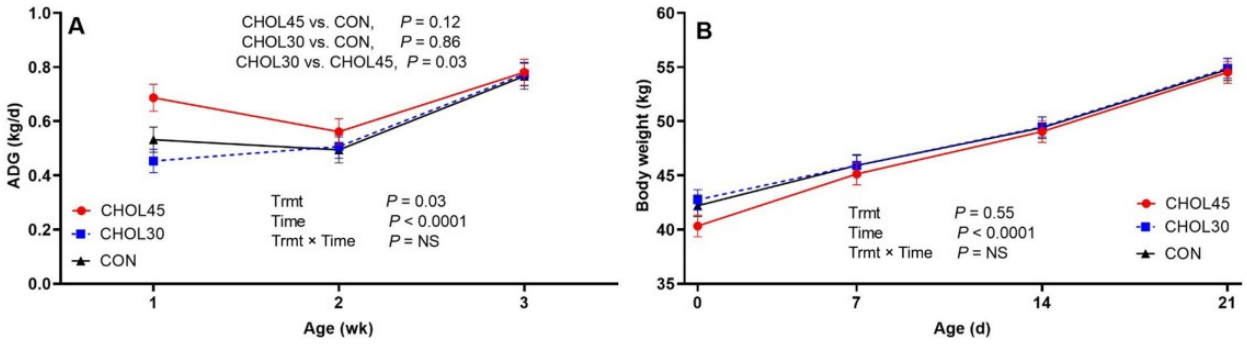
Minimal effects on growth through day 21



Swartz et al., 2022

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Highlights from MSU transition choline study

- 80% increase in colostrum yield is surprising and worth exploring
- Choline increased milk & ECM yield by ~4 kg/day, but not by diminishing the impact of LPS
- This study is the first to demonstrate in a randomized design that early lactation intramammary LPS substantially reduces peak milk yield (2+ kg/d)
- Some hints of improved oxidative balance and inflammatory status in calves exposed in utero, but no apparent effects on growth

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Questions/comments:

Barry Bradford

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