

Dietary Choline for Transition Cows and Calves - An Update

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Balchem Corporation

Acknowledgements to:

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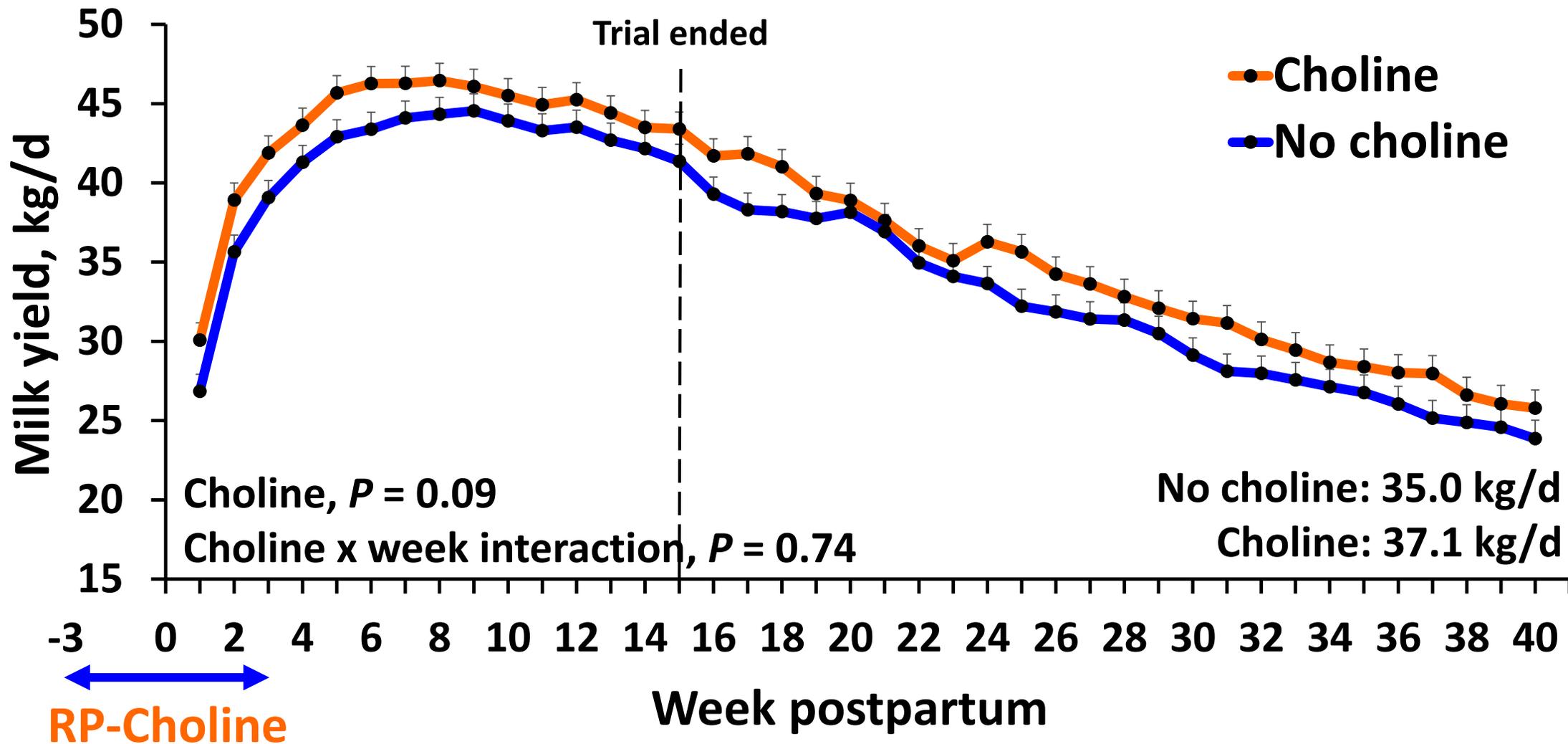
Effects of supplementation with ruminally protected choline on performance of multiparous Holstein cows did not depend upon prepartum caloric intake

**M. G. Zenobi, R. Gardinal,¹ J. E. Zuniga,² A. L. G. Dias,³ C. D. Nelson, J. P. Driver, B. A. Barton,⁴
J. E. P. Santos, and C. R. Staples⁵**

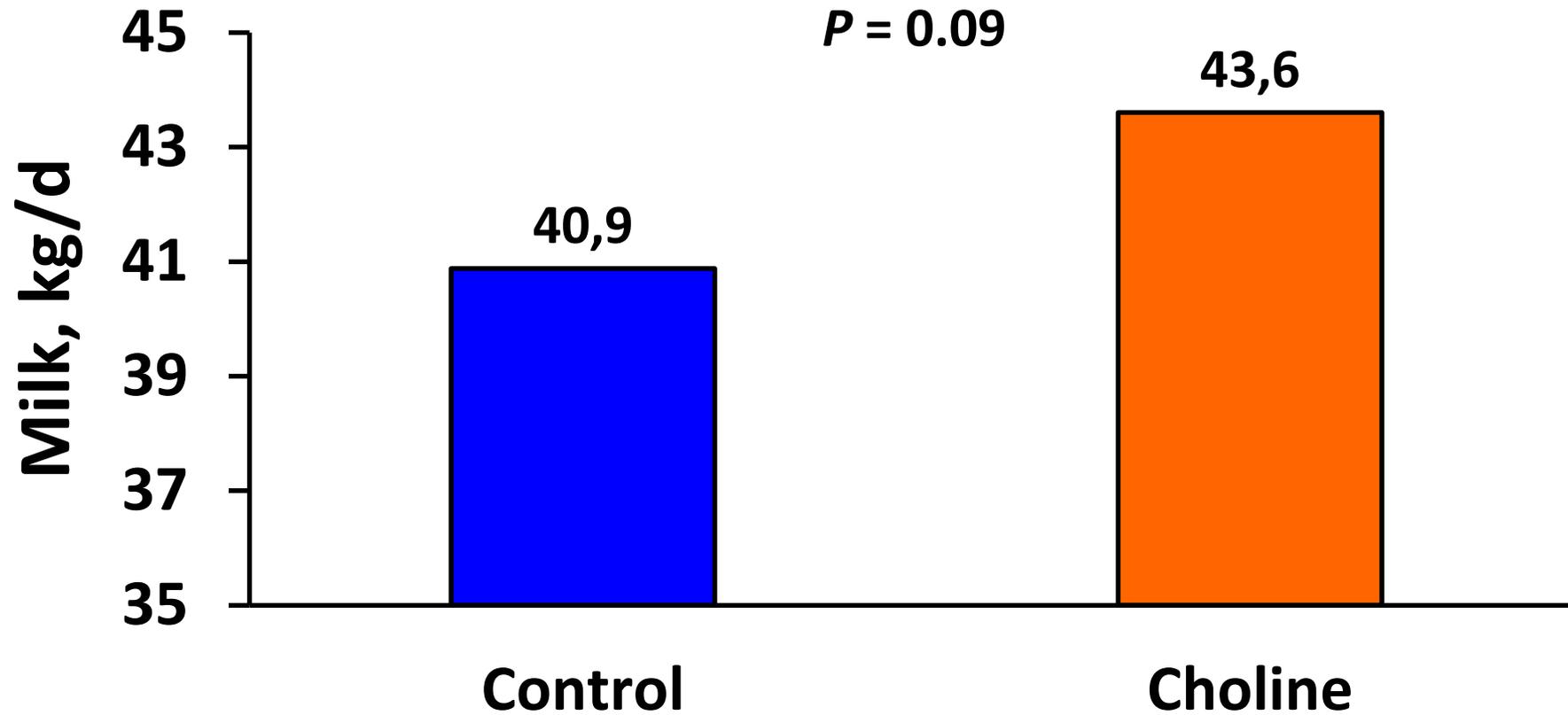
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Positive benefits of ReaShure continued after supplementation ceased



ReaShure Increased Milk Yield (from 1 to 105 DIM) in Cows at Recommended Body Condition



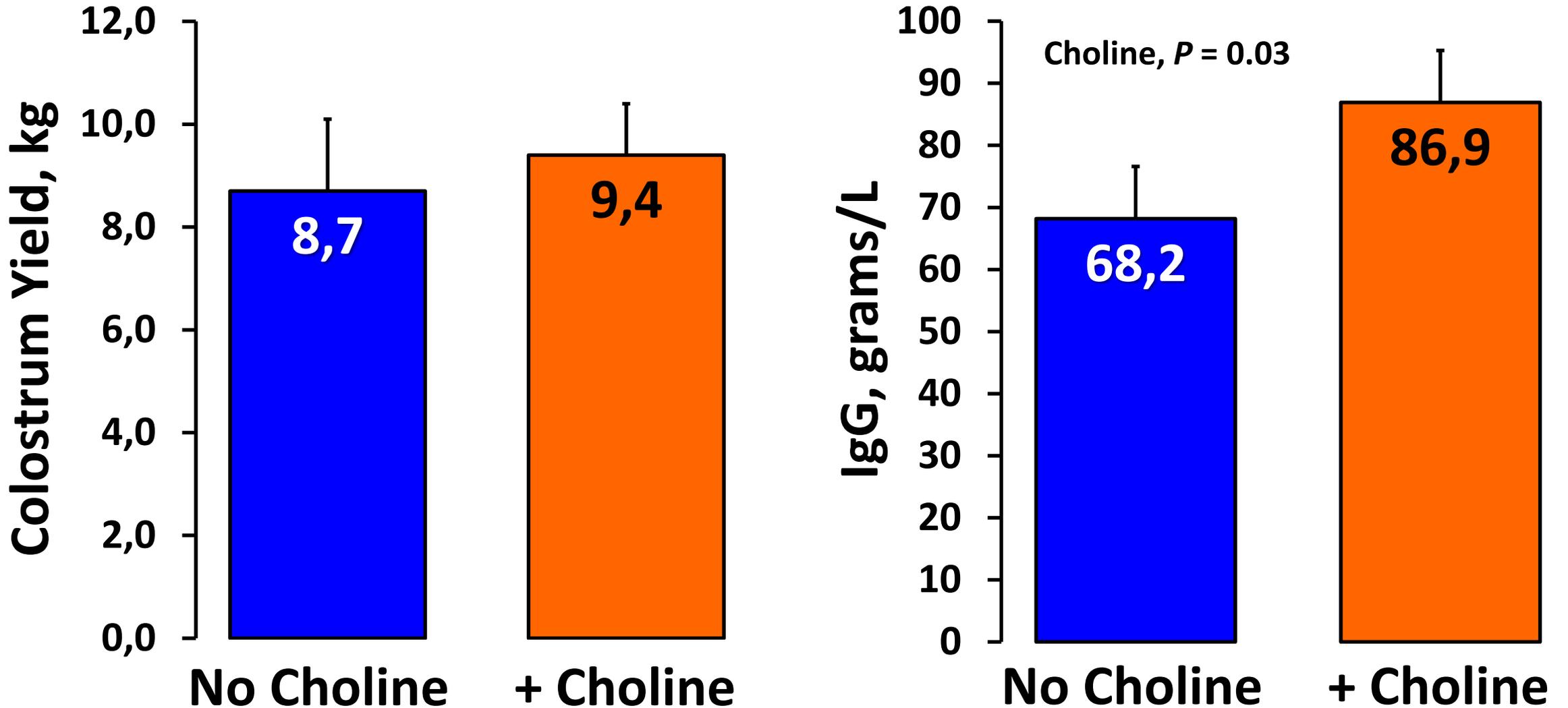
76 cows with BCS \leq 3.50 at calving

Conclusions

The response (milk yield) to dietary choline by the multiparous Holstein cow is most evident when supplemented during late pregnancy and early lactation.

- **Similar results to previous trial were ...**
 - **The effect of RPC supplementation on milk yield persisted beyond 21 d**
 - **Cows in in BCS \leq 3.5 respond to RP-Choline**
 - **Less Subclinical hypocalcemia in RP-Choline fed cows**

Colostrum Yield and Score (brix)¹



¹ Brix values were transformed using equation reported by Biemann et al. (2009)

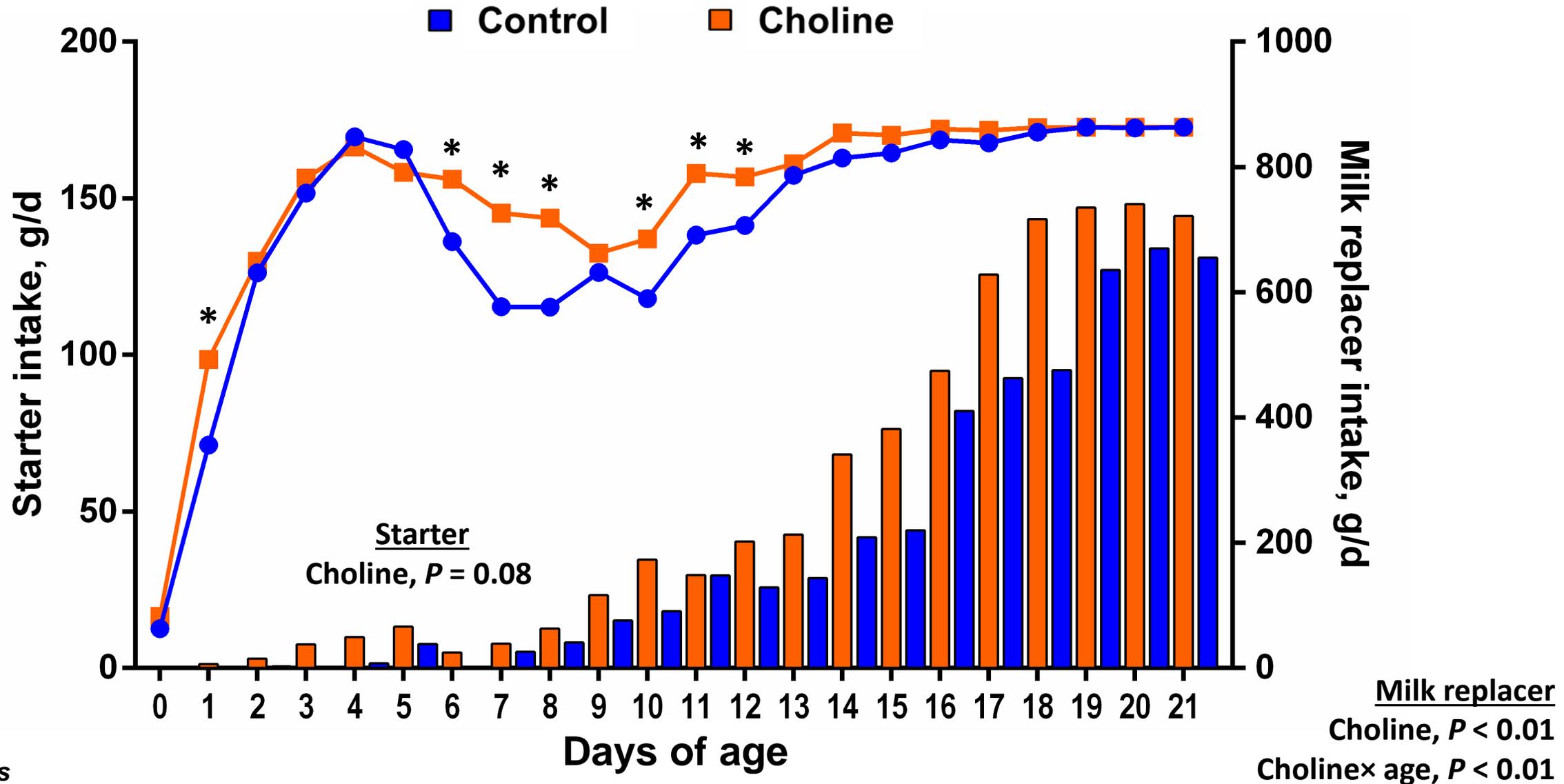
Prenatal Choline Supplementation Improved Health and Growth of Neonatal Holstein Calves

M.G. Zenobi*, J.M. Bollatti, N.A. Artusso, A.M. Lopez, B.A. Barton,
J.E.P. Santos, and C.R. Staples

ADSA 2018
Abstract # 274

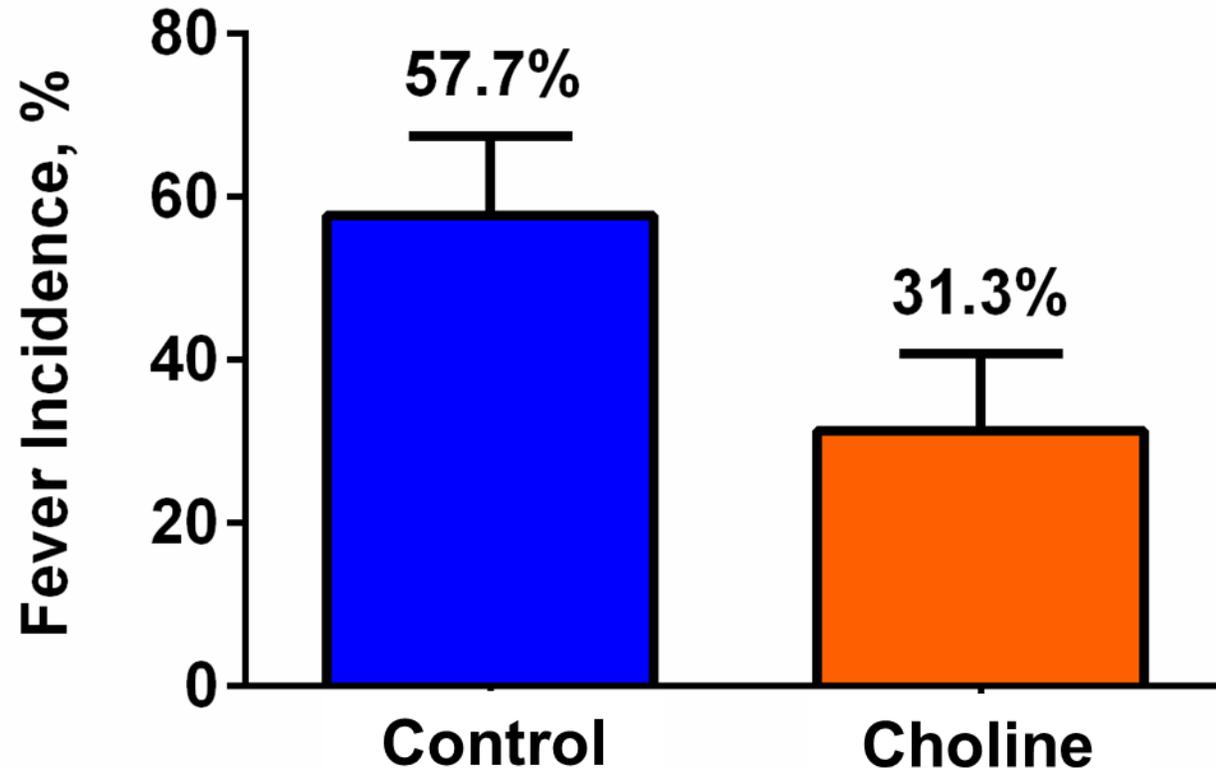


Late Gestation Exposure to ReaShure Increased DMI of Milk Replacer and Starter During the First 21 d of Age of Heifers

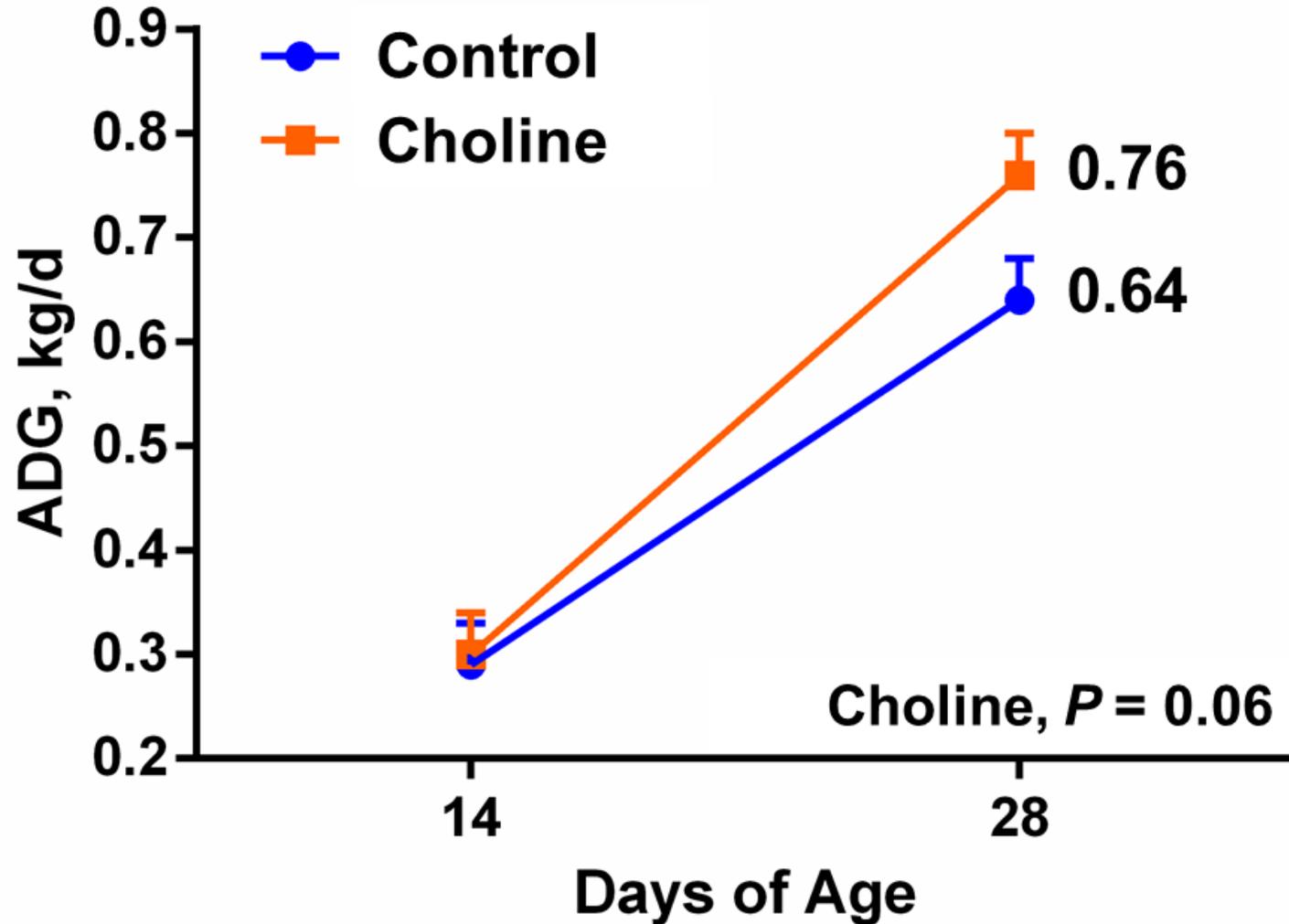


Late Gestation Exposure to ReaShure Decreased Incidence of Fever During the First 21 d of Age of Holstein Heifers

Choline, $P = 0.07$



Late Gestation Exposure to ReaShure Increased ADG at 28 d



Effect of Transition Feeding of ReaShure on Growth of Replacement Heifers

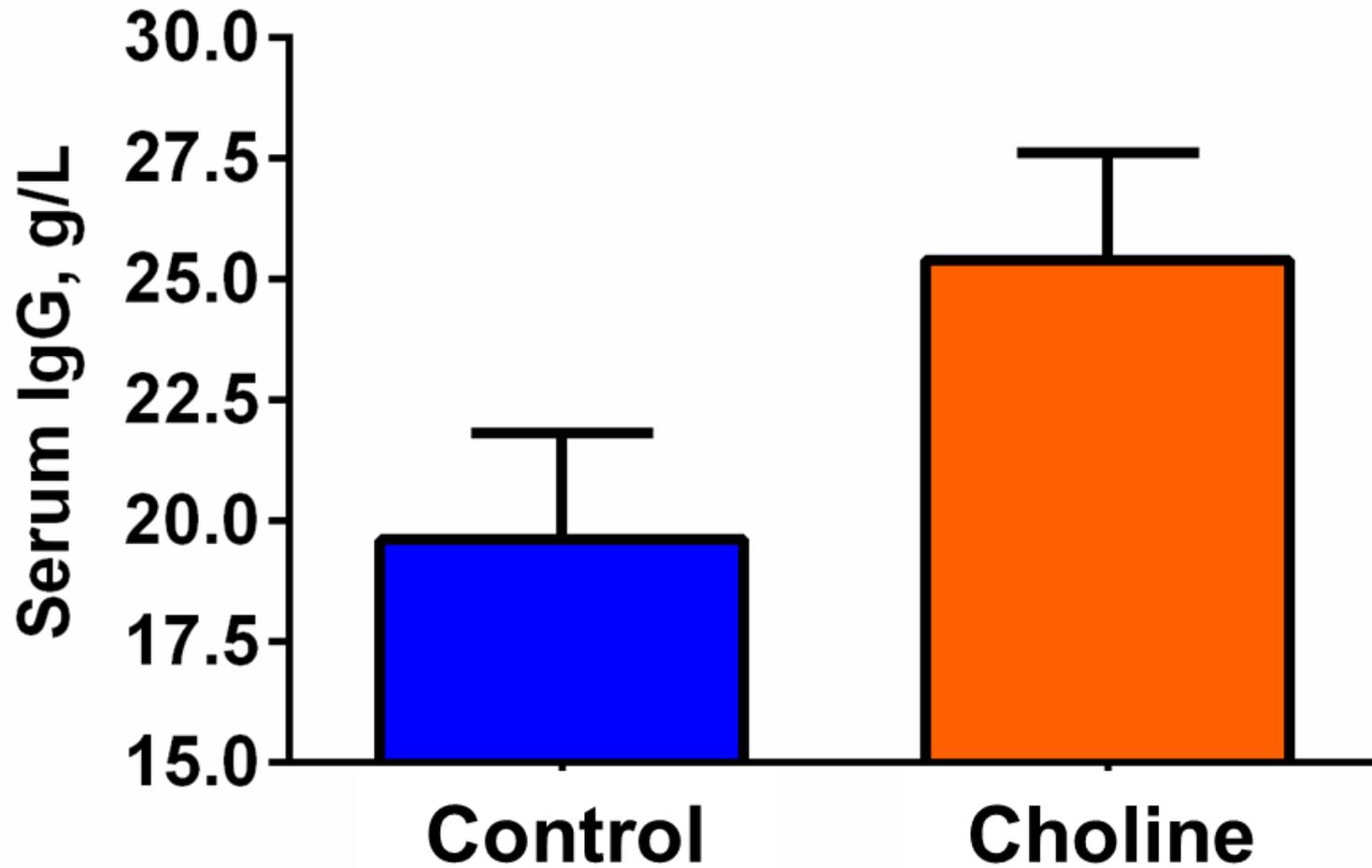
Age	Control	Choline	SEM
	n = 23	n = 23	--
Birth, kg	42.0	40.7	1.6
56 d of age, kg	73.2	73.6	2.0
300 d of age, kg	274	286	5.5

*Effect of choline, $P < 0.10$.

Average daily gain from weaning to yearlings:
No choline: 0.83 kg per day
Choline: 0.87 kg per day *

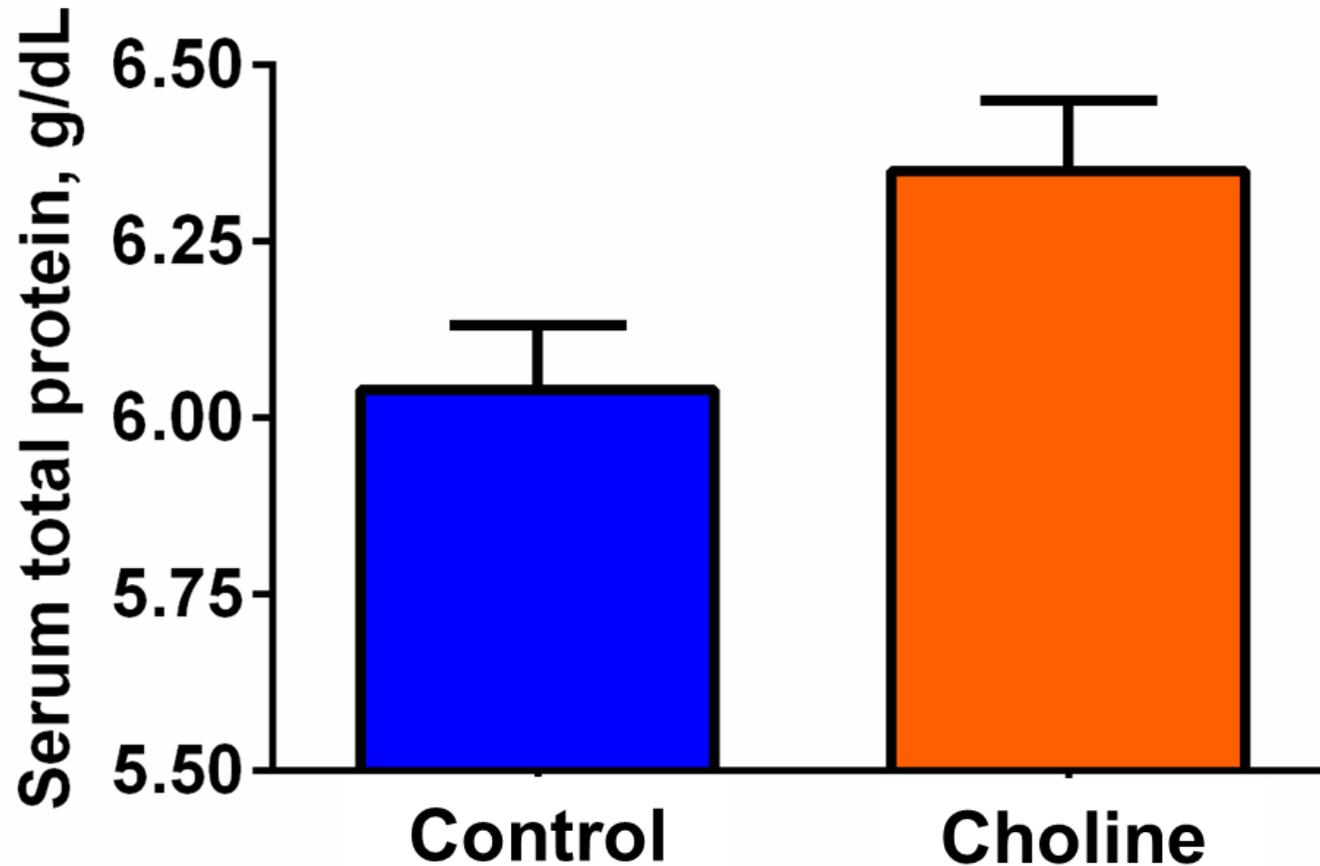
Serum IgG

Choline, $P < 0.01$



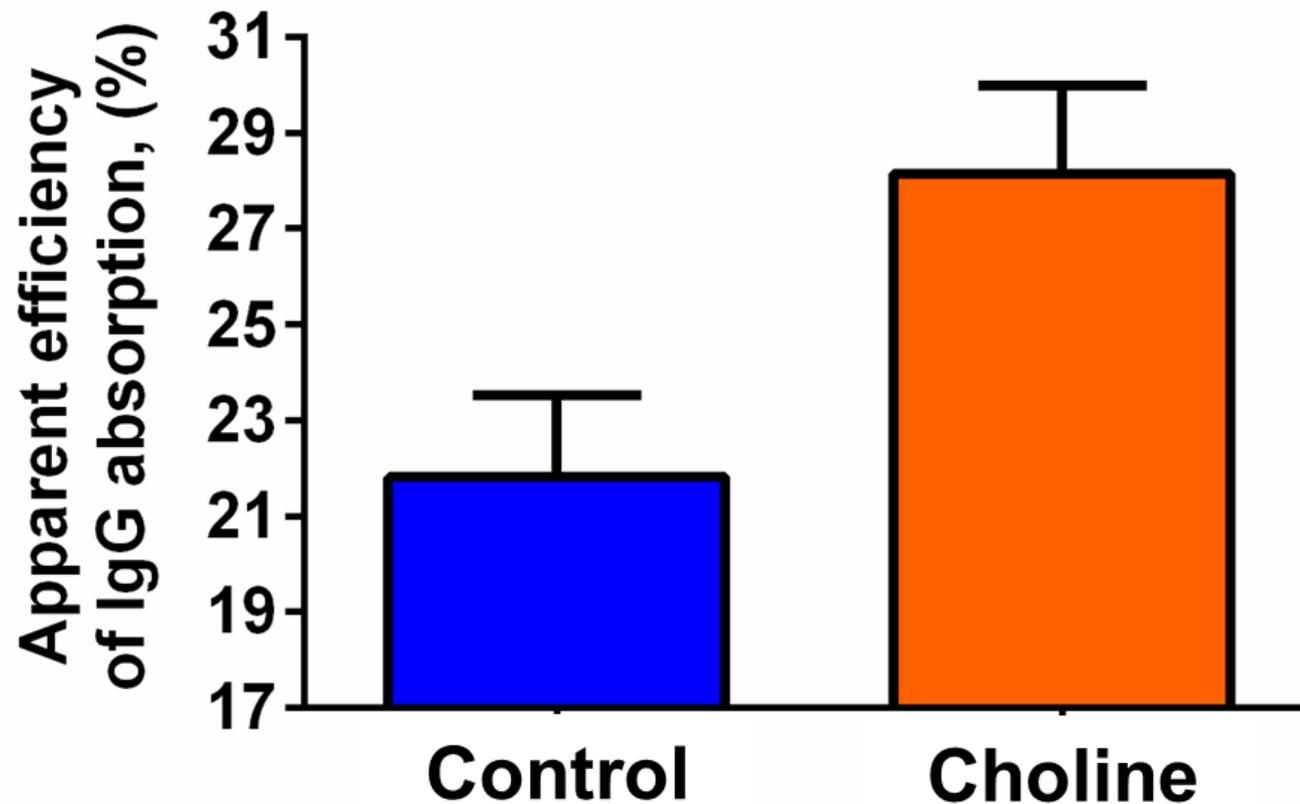
Serum Total Protein

Choline, $P = 0.02$



Apparent Efficiency of IgG Absorption (n = 59)

Choline, $P = 0.01$



Prenatal choline supplementation modulated LPS-induced inflammatory responses of neonatal Holstein calves

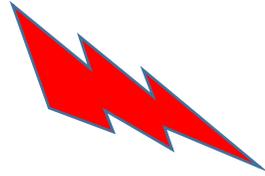
**M.G. Zenobi*, J.M. Bollatti, N.A. Artusso, A.M. Lopez, F.P. Maunsell,
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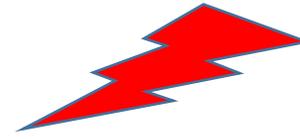
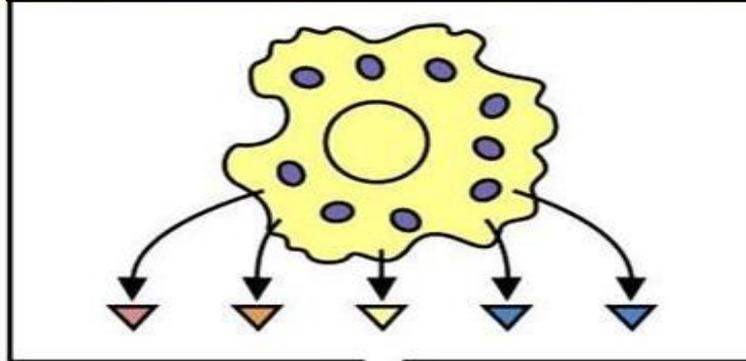
Late-Breaking Original Research # LB5



Bacterial LPS



Activated macrophages secrete a range of cytokines



Bacterial LPS



Liver



Acute phase proteins

Fat, Muscle



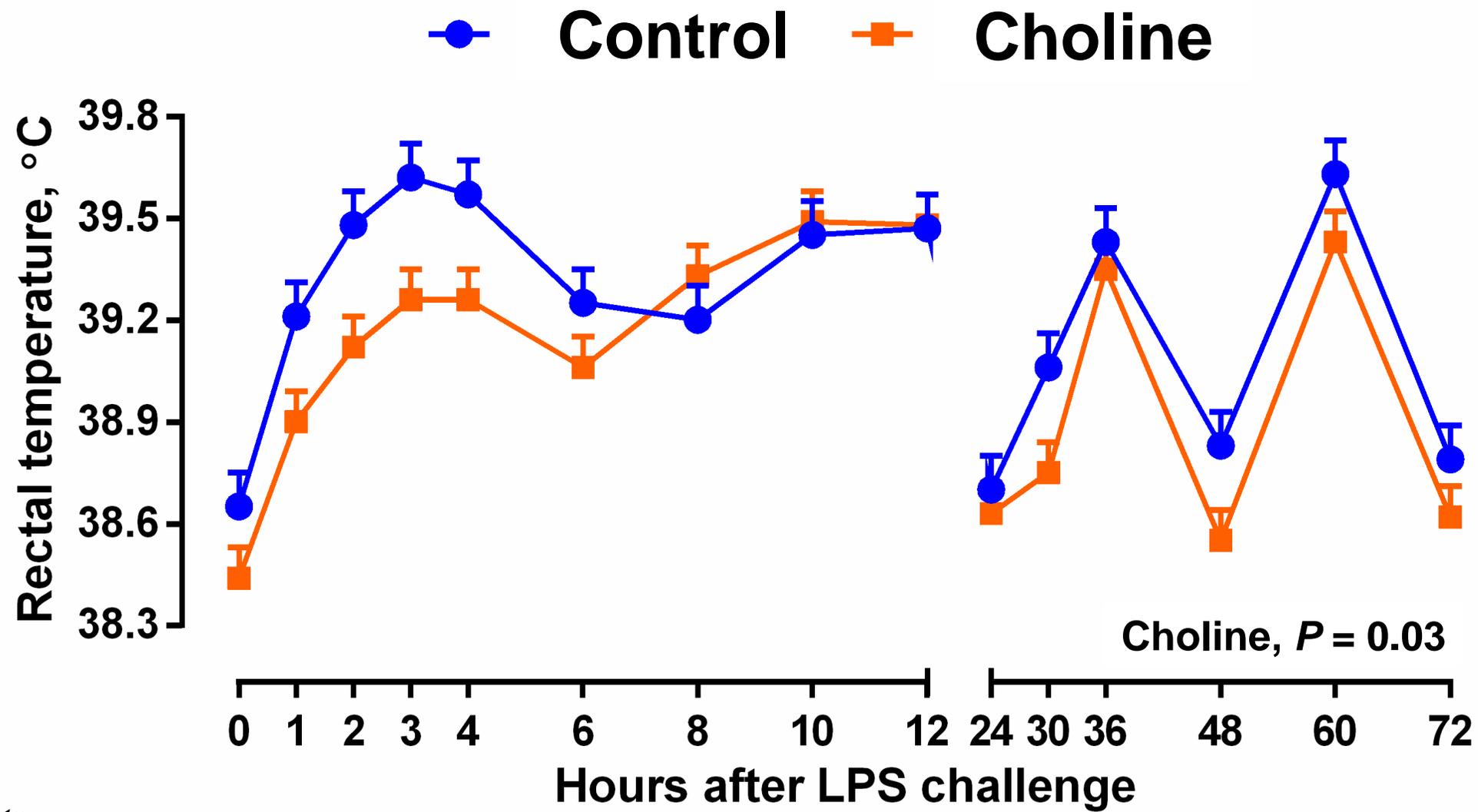
Protein and energy mobilization to generate increased body temperature

Hypothalamus

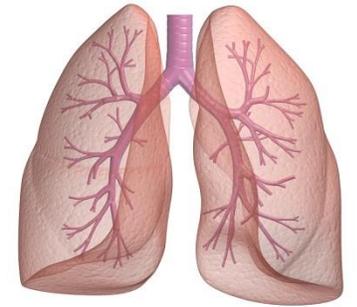
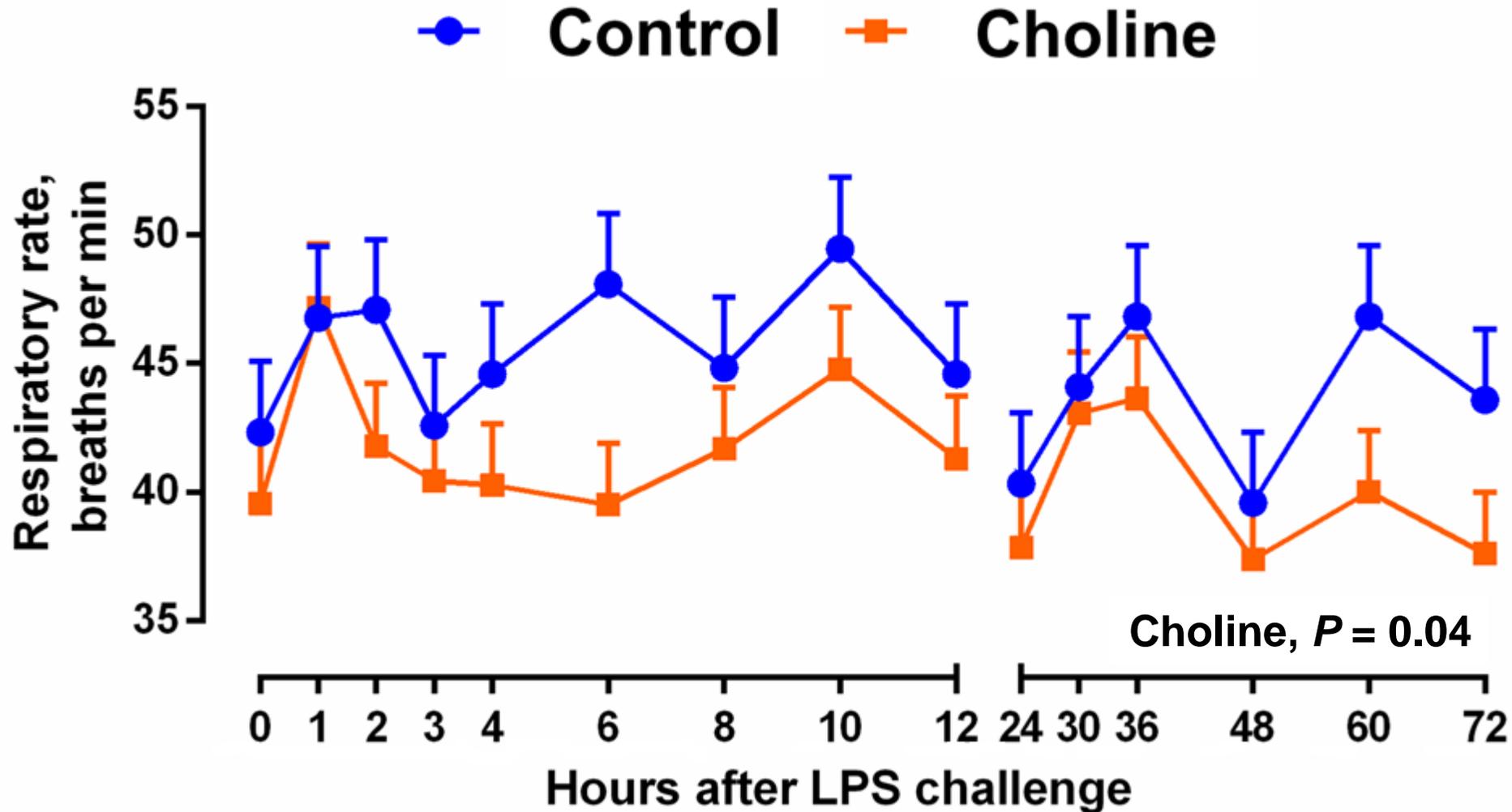


Increased body temperature

Rectal Temperature Response to LPS of Calves Born From Dams Fed ReaShure

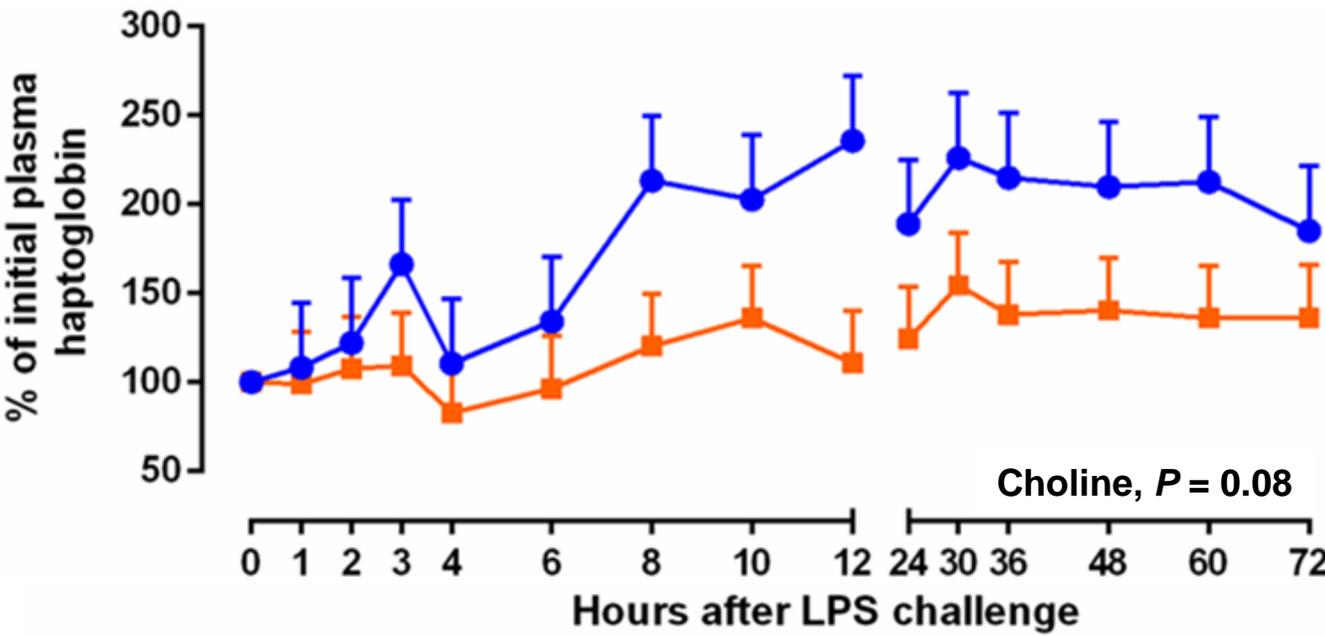
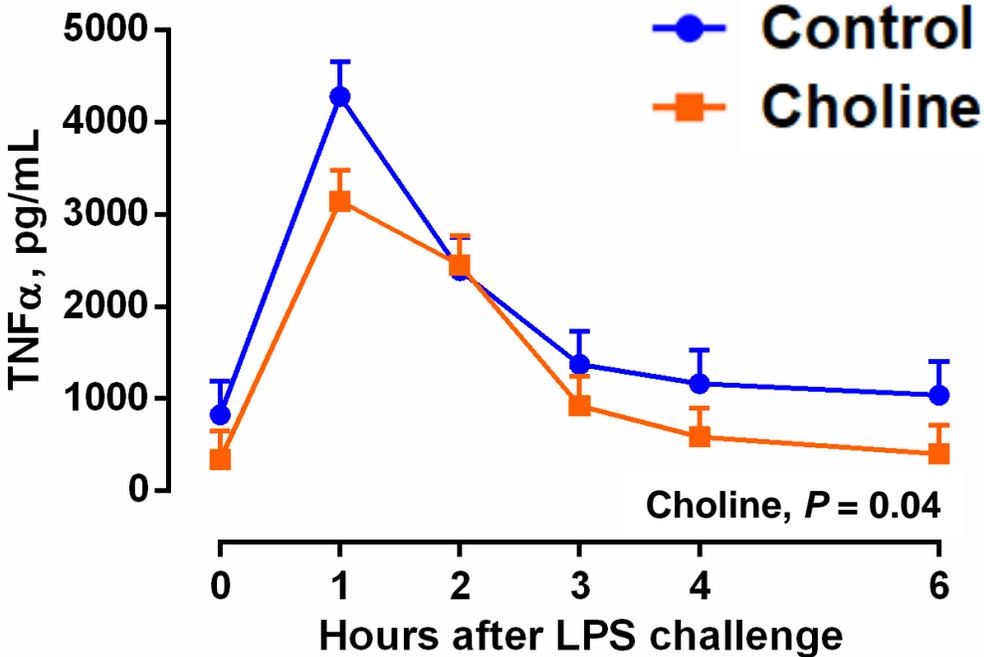


Respiratory Responses to LPS of Calves Born From Dams Fed ReaShure



Major target organ of LPS

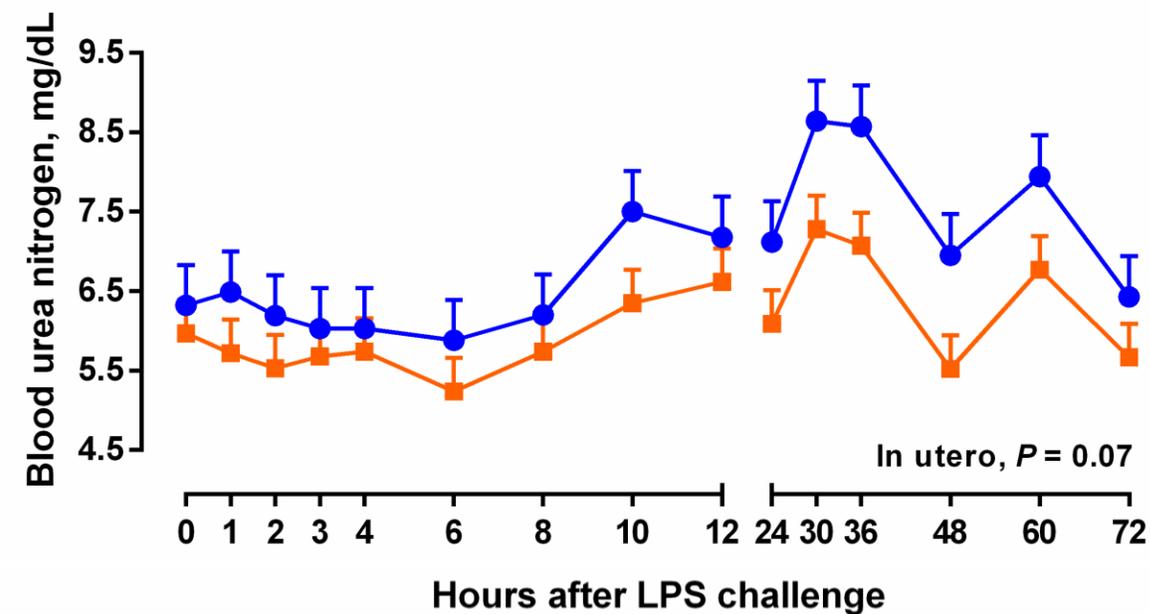
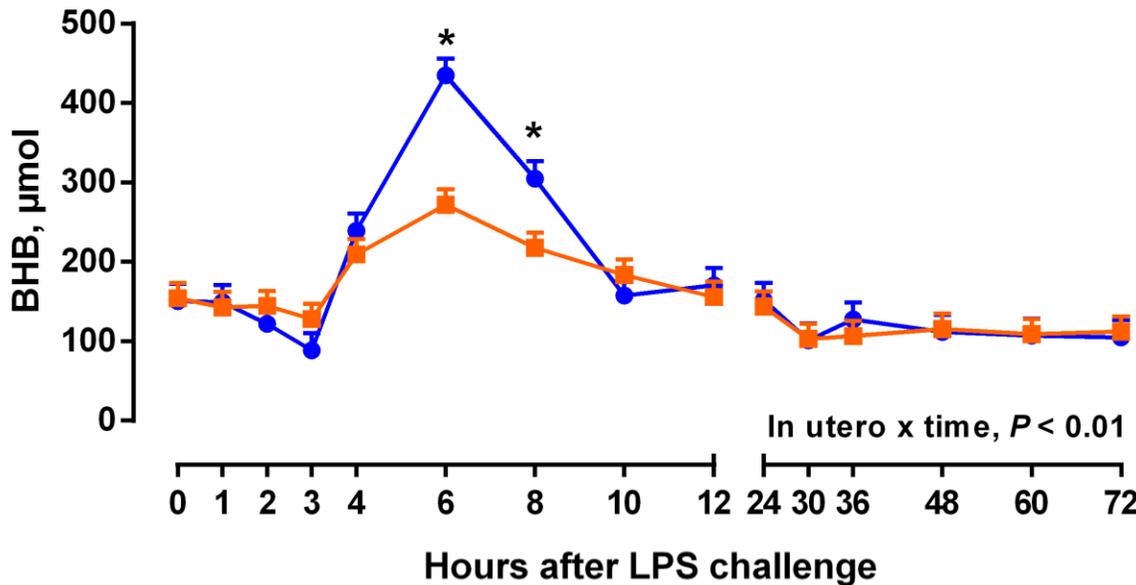
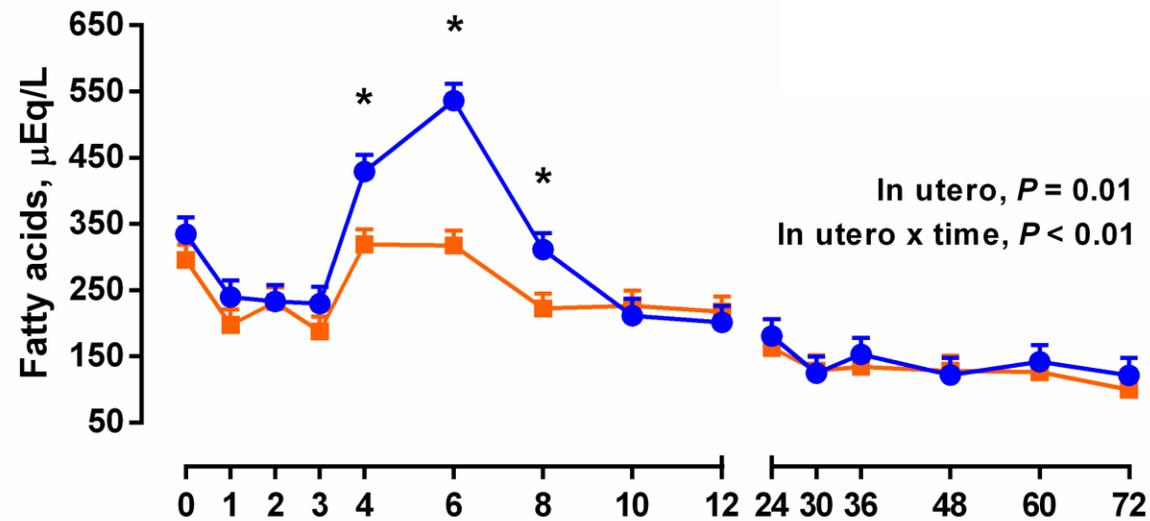
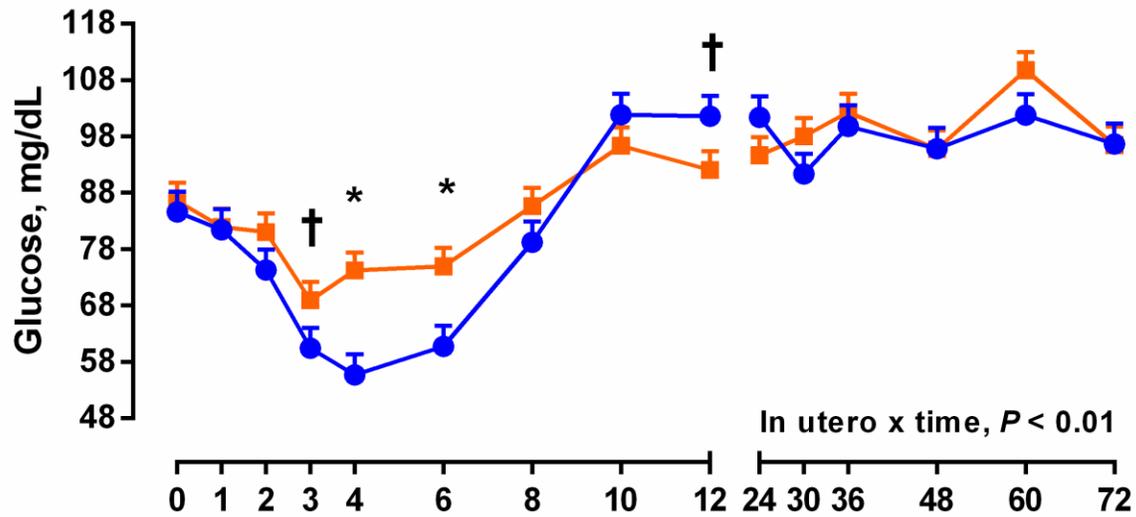
Tumor Necrosis Factor- α and Interleukin-6 Responses to LPS of Bulls Born From Dams Fed ReaShure



In utero effects

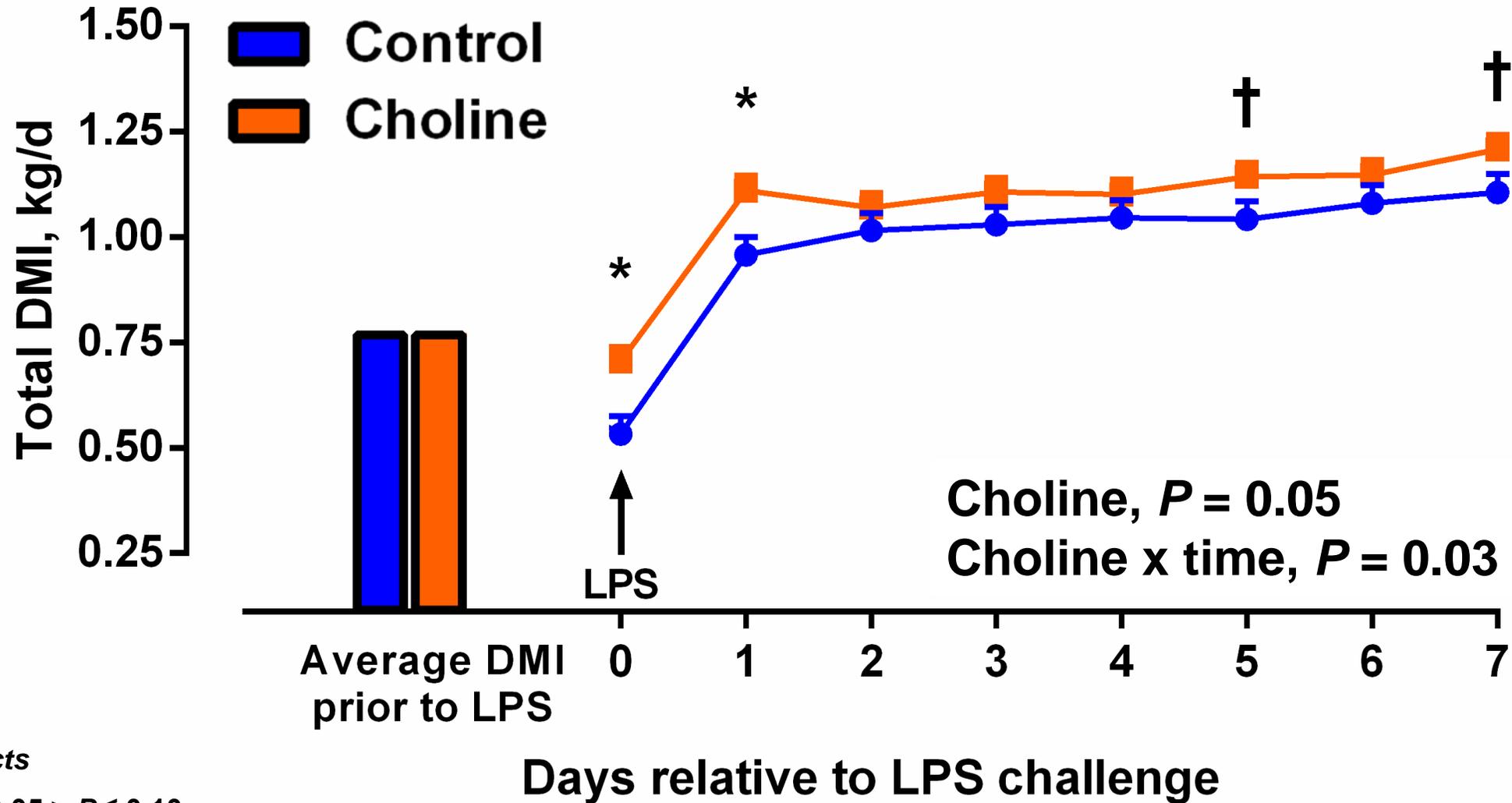
● Control (- In utero)

■ Choline (+ In utero)



* $P \leq 0.05$, † $0.05 > P \leq 0.10$

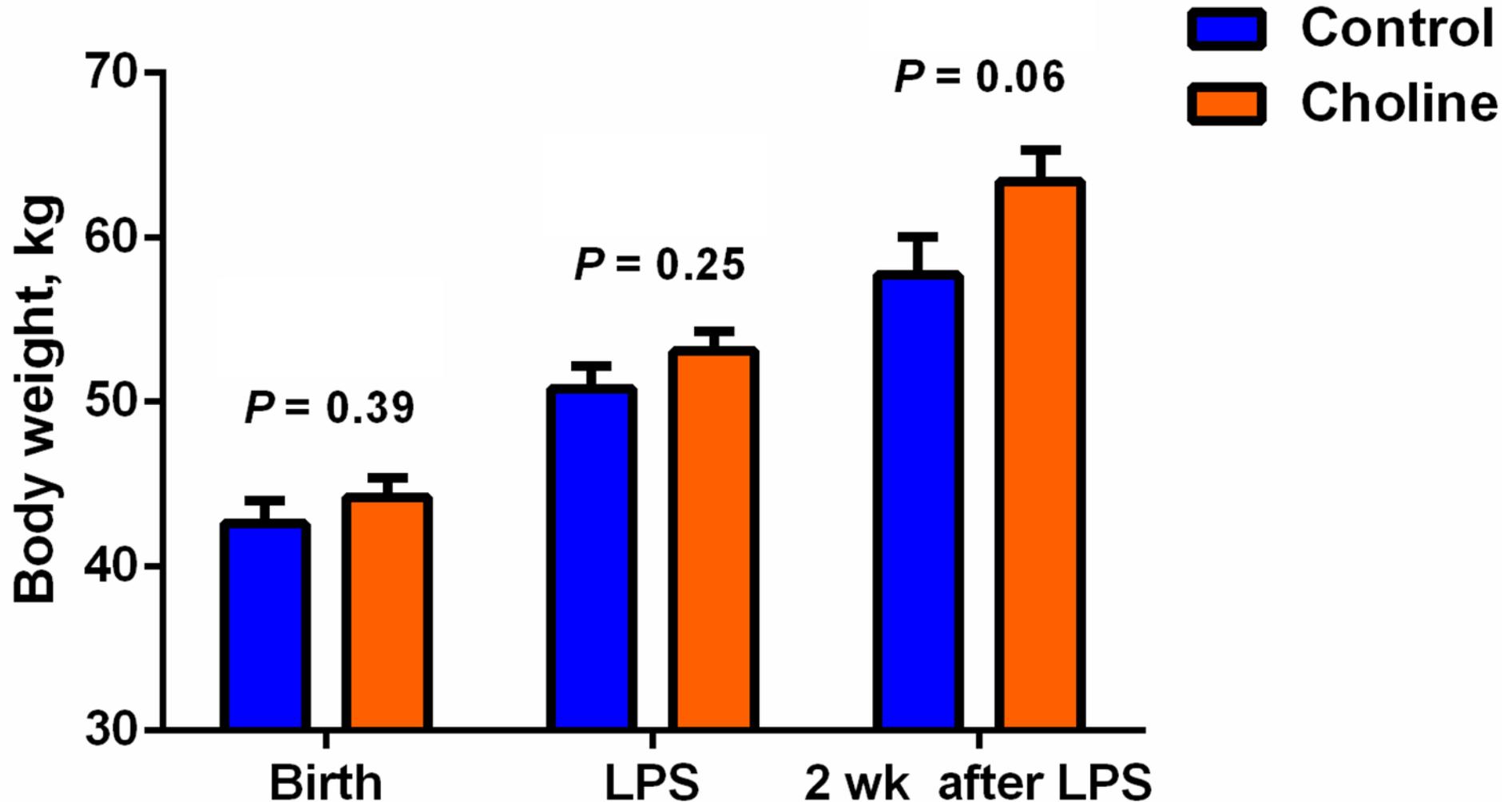
Greater DMI after LPS administration for Calves Born From Dams Fed ReaShure



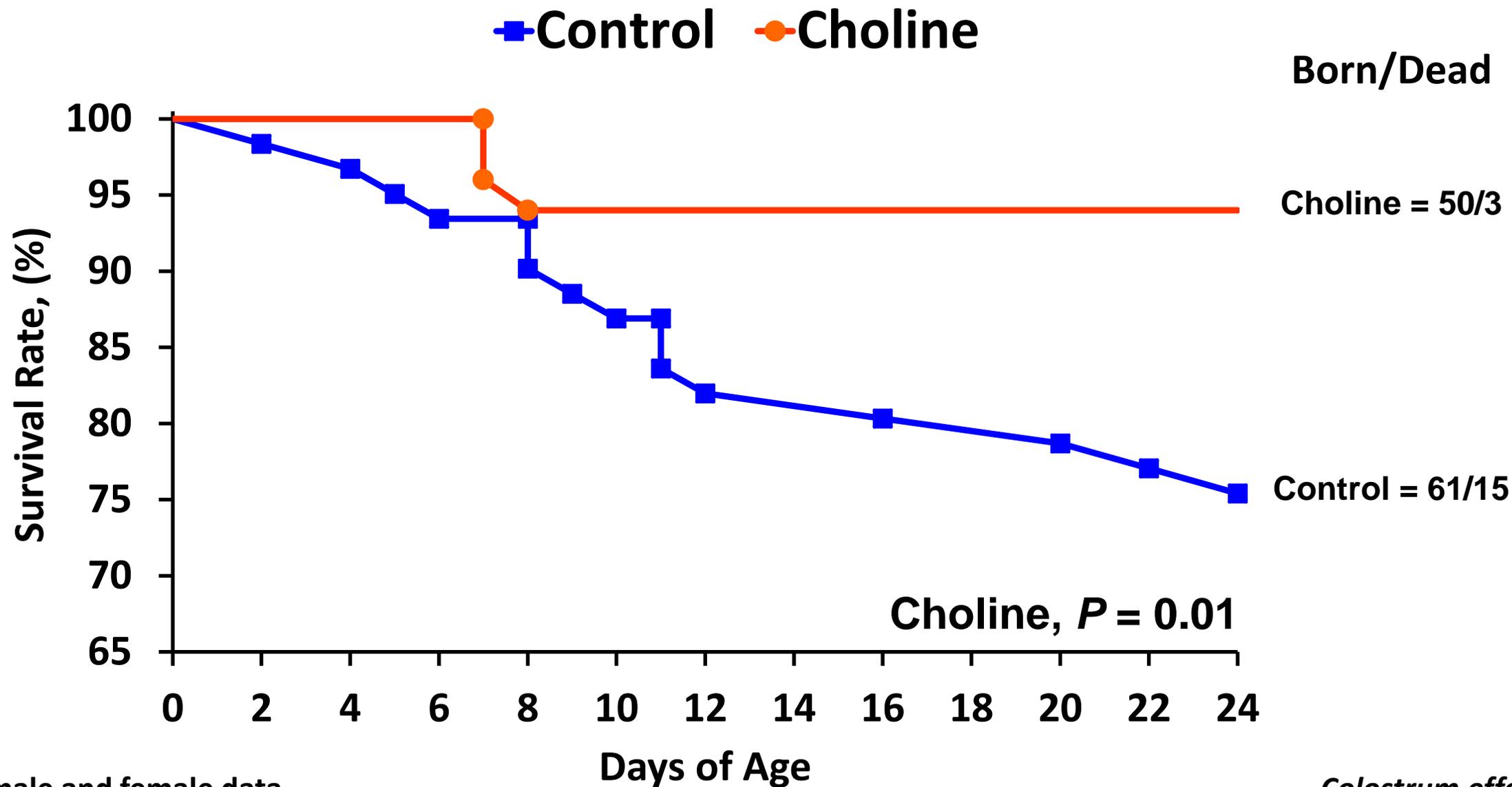
In utero effects

* $P \leq 0.05$, † $0.05 > P \leq 0.10$

Body Weight After LPS Administration of Calves Born From Dams Fed ReaShure



Survival Curve using Bulls and Heifers Data



Effect of Prepartum Feeding of ReaShure on Growth of Replacement Heifers

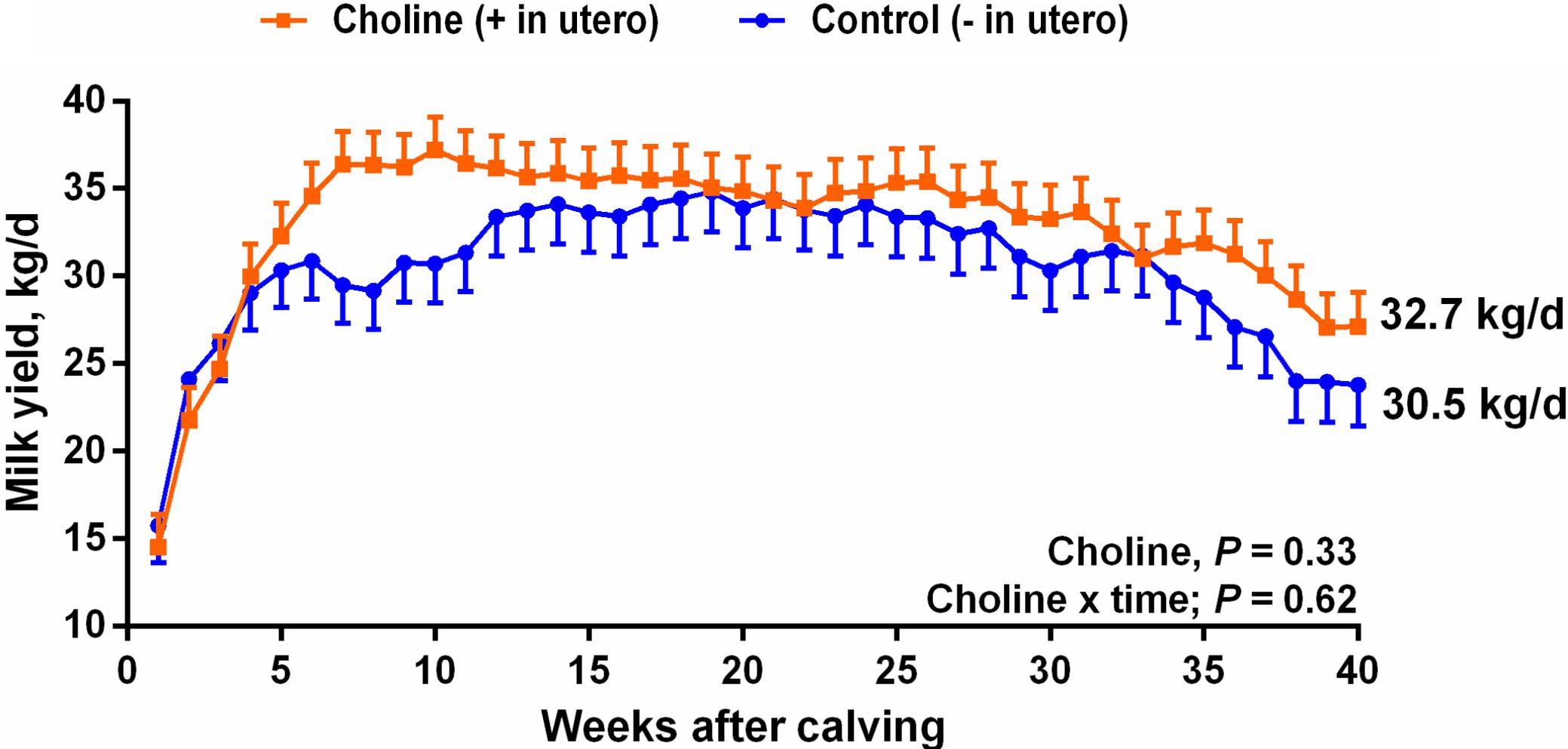
Age	No Choline	+ Choline	SEM
	n = 17	n = 18	--
Birth, kg	40.4	38.3*	0.9
2 months (weaning), kg	76.7	77.4	1.8
12 months, kg	322	335**	5
Post-calving, kg	534	570**	16

*Effect of choline, $P < 0.10$.

**Effect of choline, $P \leq 0.05$.

Average daily gain from weaning to yearlings:
 No choline: 0.85 kg per day
 Choline: 0.89 kg per day**

Milk Yield of Primiparous Cows Exposed to ReaShure *in Utero*



Heat stress in utero has the following effects on the calf (Dahl)

- Decreased birth weight
- Greater incidence of Failure of Passive Transfer Poorer immune function
- Poorer feed efficiency
- ***Decreased milk production (~ 11 lbs/d) during first lactation***

“In utero programming”