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Influence of incomplete milking on the metabolic and oxidative stress status in early-lactating cows with high lipolysis

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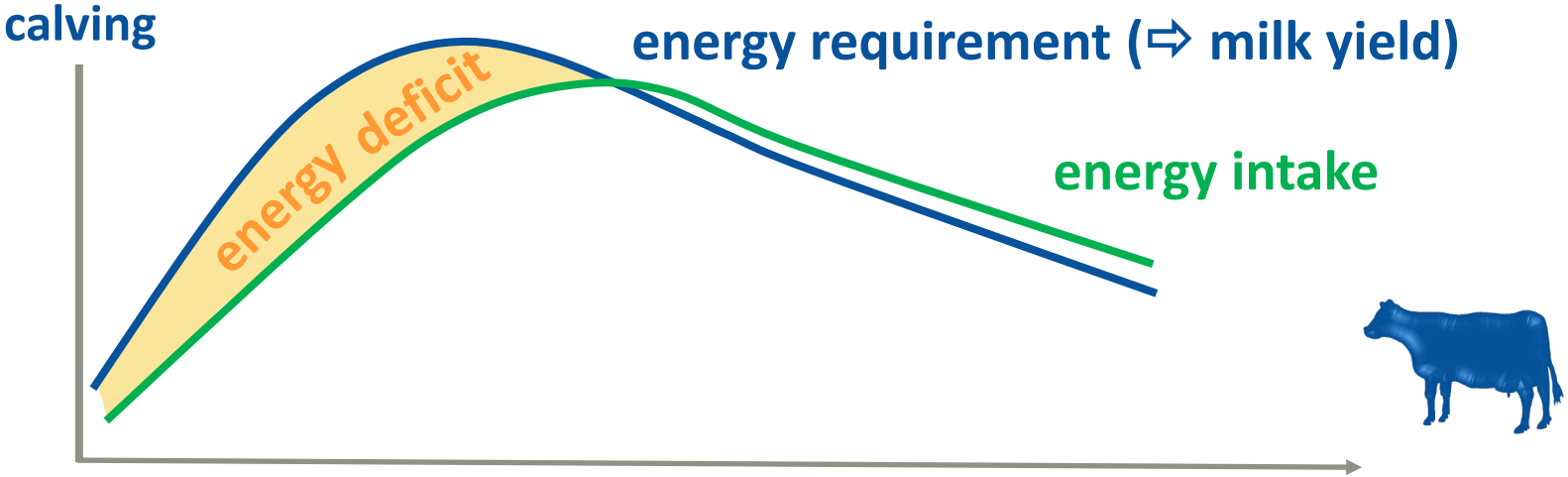
75. EAAP Annual Meeting 2024

in Florence

Energy deficit in early lactation



High energy demands around calving ⇨increasing energy deficit

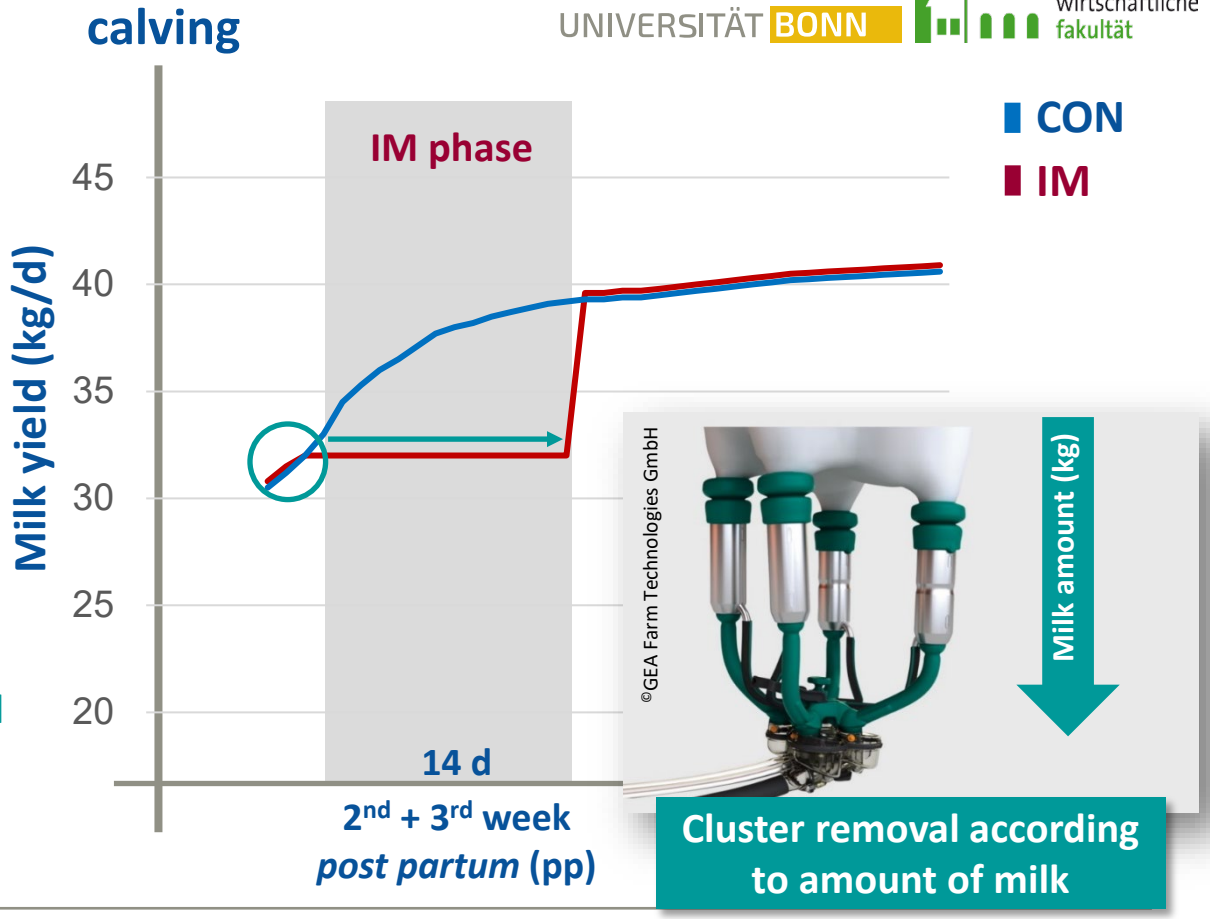
⇨ high-yielding cows mobilize body fat (= lipolysis)

⇨ metabolic and oxidative stress (Bernabucci et al. 2005, Schuh et al. 2019 etc.)

Hypothesis

Temporary incomplete milking (IM) can positively affect the metabolism of cows with high lipolysis in early lactation.

IM by the software-module of Schmidt et al., 2017 (International patent WO 2019/048,521 A1)



Study design

at research farm

Campus Frankenforst

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Feed intake and analyses

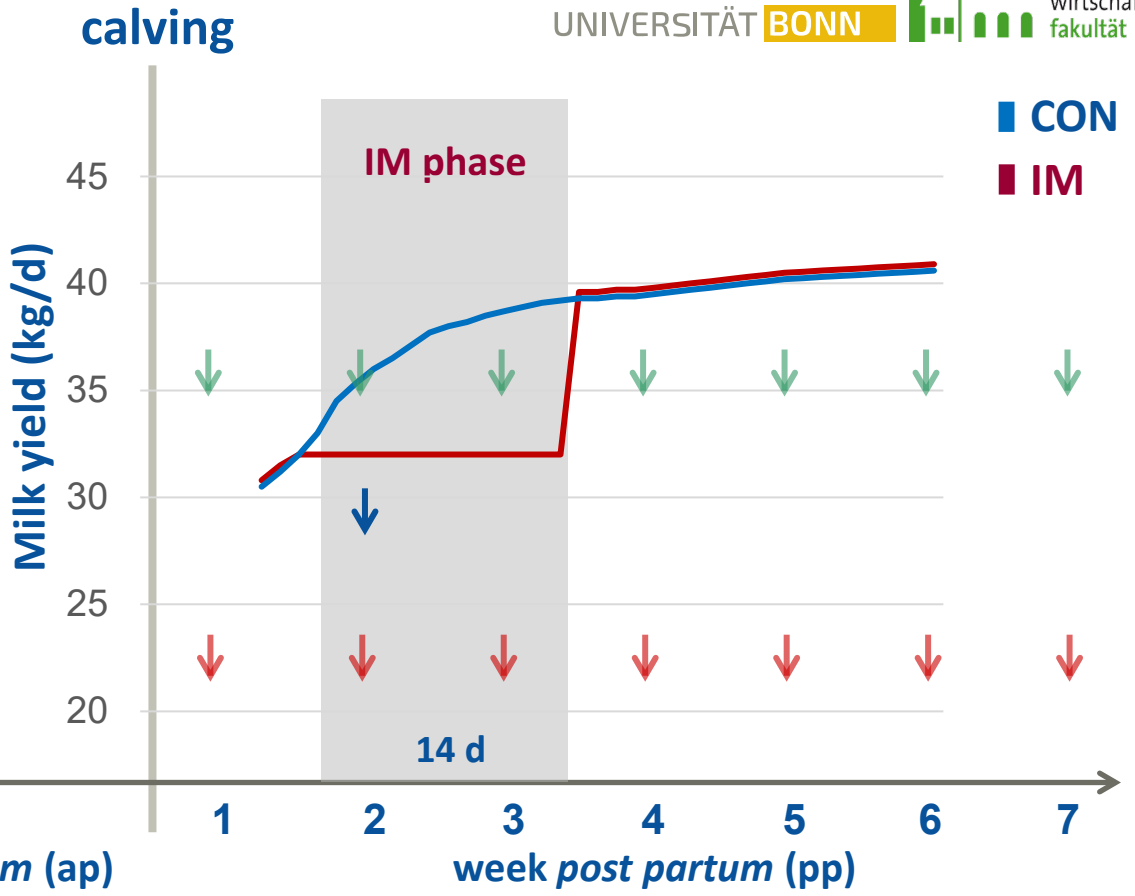
Back fat thickness (BFT)

Blood serum

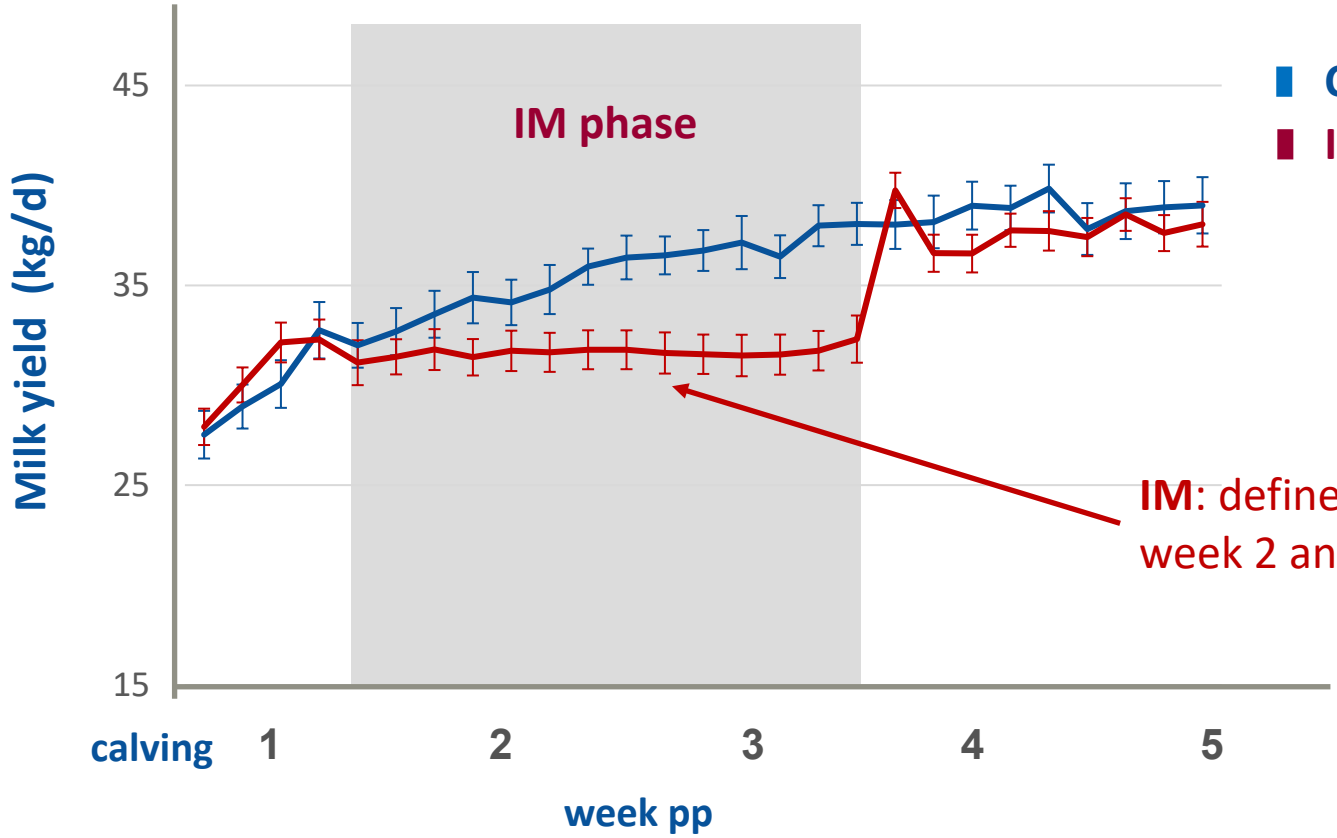
→ Fatty acids (FA)

→ ß-hydroxybutyrate (BHB)

→ derivatives of reactive oxygen metabolites (dROM)



Milk yield (kg/d, mean ± SE)



Meyer et al. 2024

Conclusion of the first analyses

-> published in JDS 2024 (Meyer et al.)

- ✓ Applicability of the milking software module used for delaying the increase of milk yield during the early lactation was shown.
- ✓ When IM ceased, milk production of the IM cows immediately reached the level of the CON cows.
- ✓ Udder health not compromised throughout the observation period.
- ✓ **CON and IM do not differ in their metabolic status.**

J. Dairy Sci. 107:628–641
https://doi.org/10.3168/jds.2023-23777

The impact of automated, constant incomplete milking on energy balance, udder health, and subsequent performance in early lactation of dairy cows

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Detailed clustering of the cows:

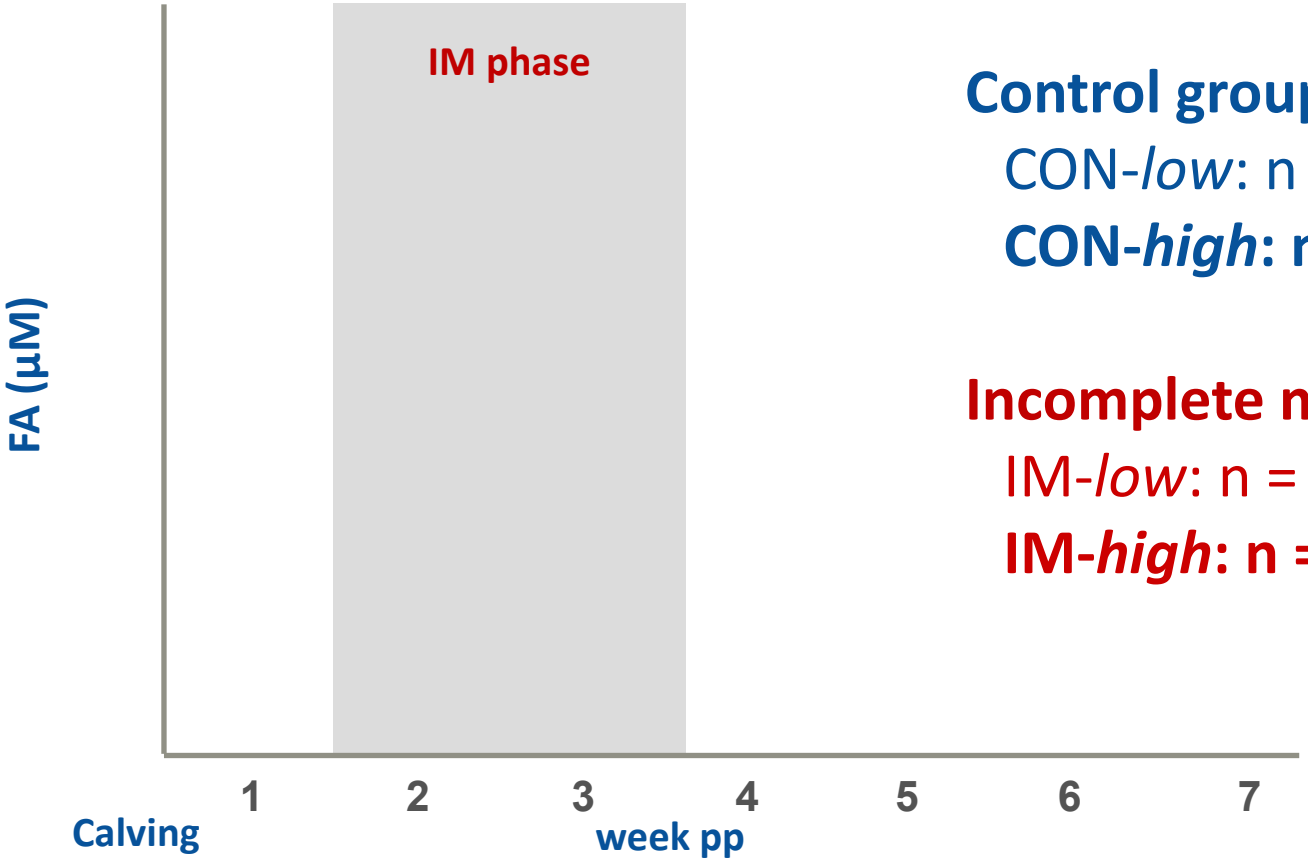
Indicators of high lipolysis

	„high cows“ n = 10	*„low* cows“ n = 36	*p*-value (Mann-Whitney-U)
FA week 1 or 2 pp			
Indicators within week 1 pp			
FA (µM)			
Energy intake (MJ NEL/d)			
Milk yield (kg/d)			
delta BFT ap to pp (%)			

FA = Fatty acid BFT = Back fat thickness

Results

FA (µM) (mean ± SE)



Control groups (CON)

CON-*low*: n = 18

CON-*high*: n = 5

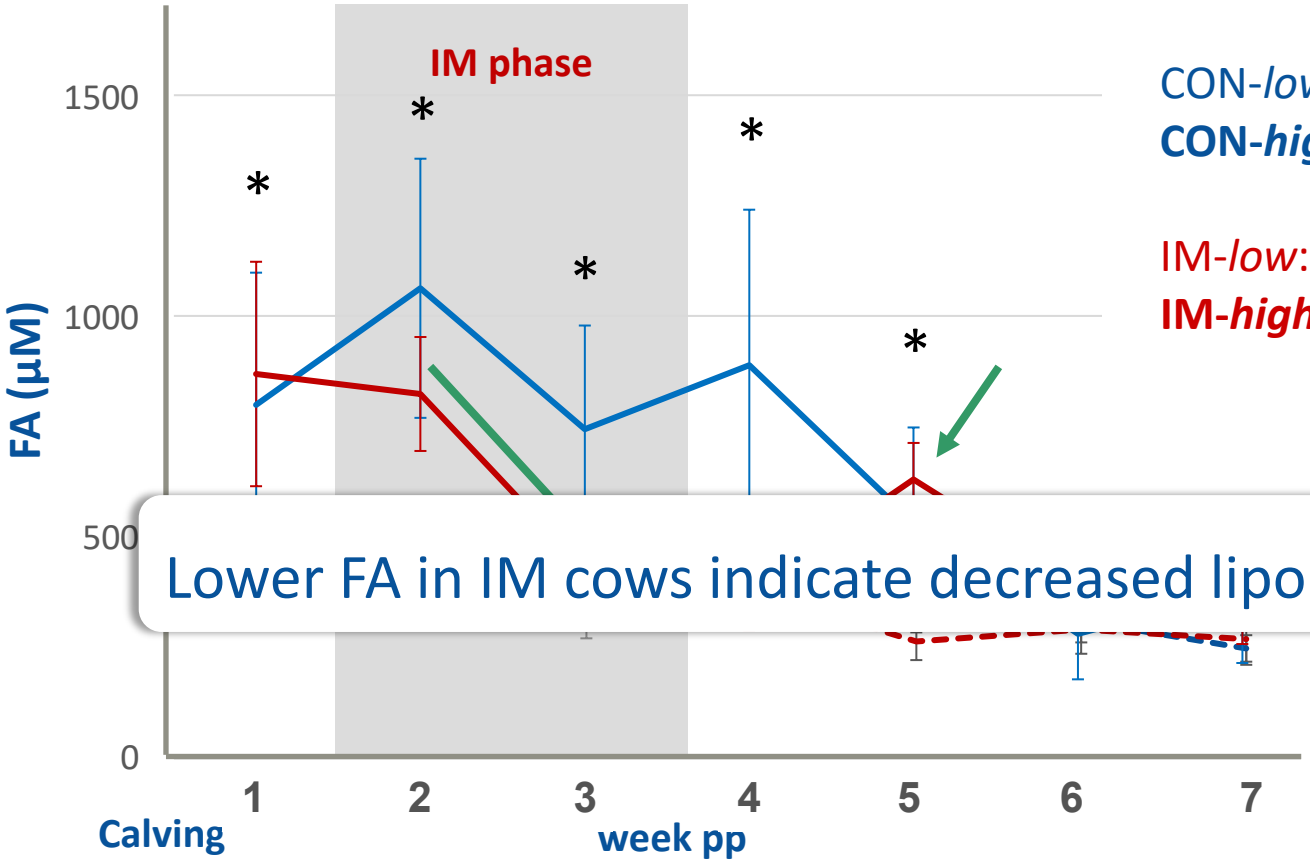
Incomplete milking group (IM)

IM-*low*: n = 18

IM-*high*: n = 5

Results

FA (µM) (mean ± SE)



CON-*low*: n = 18

CON-*high*: n = 5

IM-*low*: n = 18

IM-*high*: n = 5

Lower FA in IM cows indicate decreased lipolysis.

Time T: $p < 0.001$

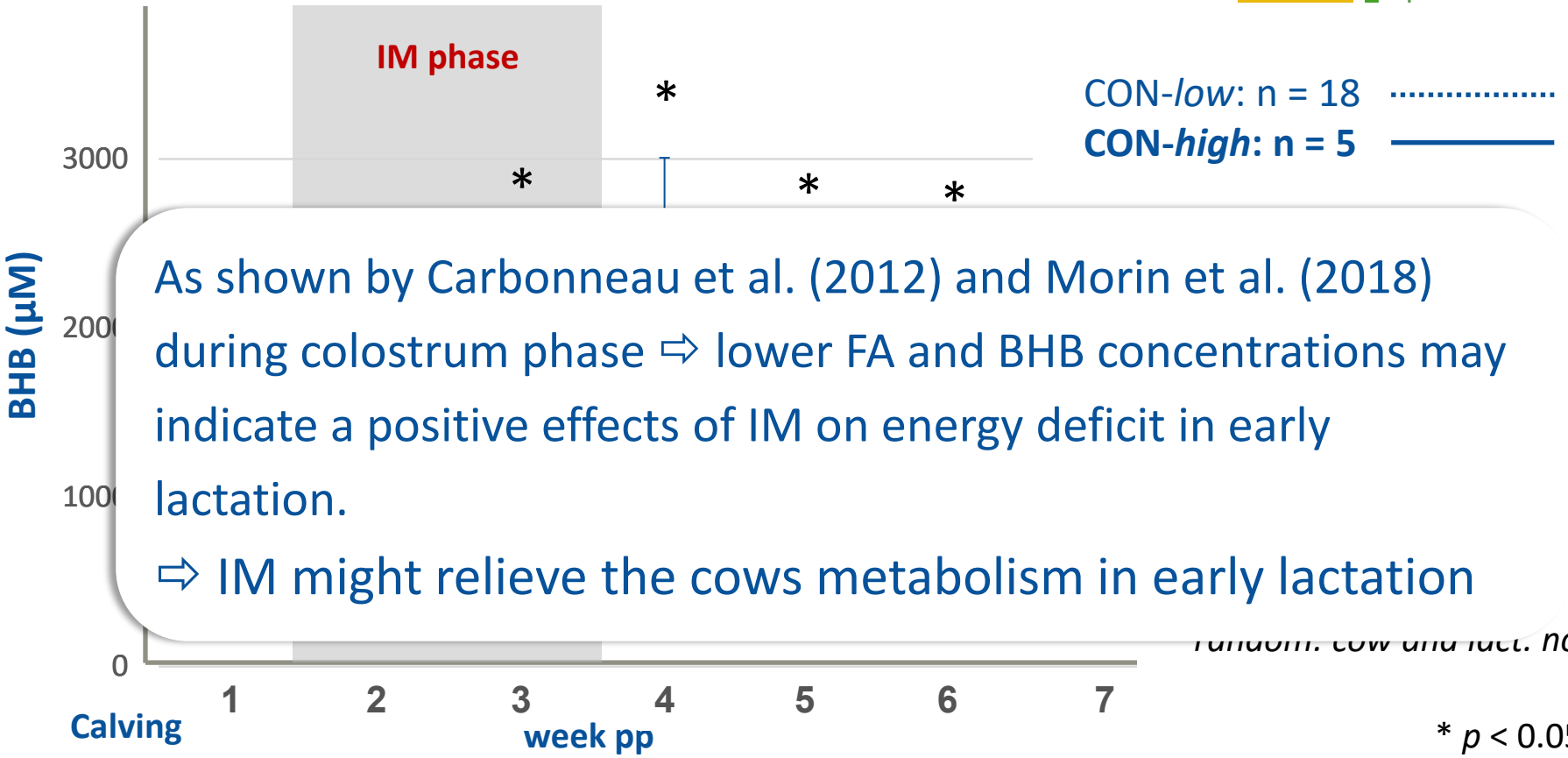
G x T: $p = 0.003$

random: cow and lact. no.

* $p < 0.05$

Results

BHB (µM) (mean ± SE)



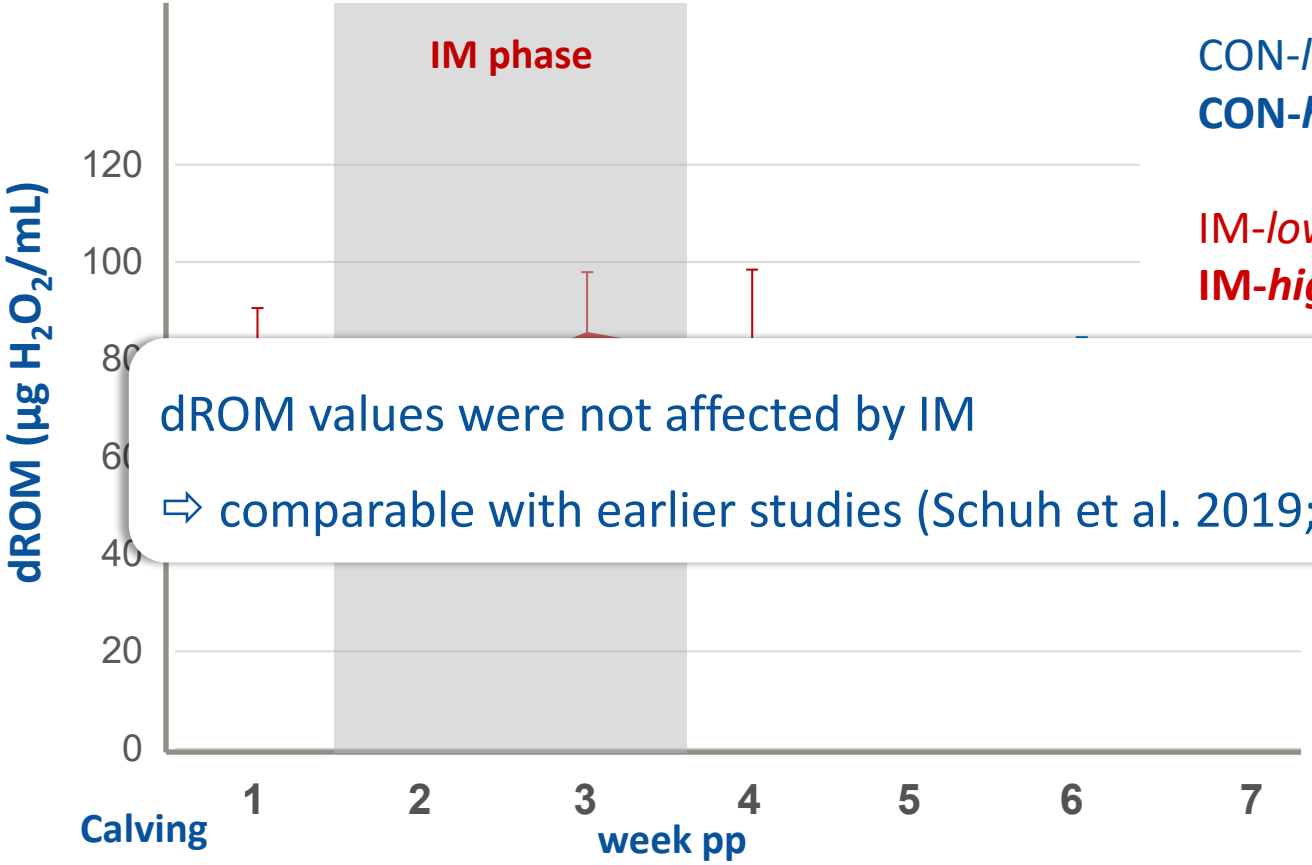
As shown by Carbonneau et al. (2012) and Morin et al. (2018) during colostrum phase ⇨ lower FA and BHB concentrations may indicate a positive effects of IM on energy deficit in early lactation.

⇨ IM might relieve the cows metabolism in early lactation

random: cow and lact. no.

* $p < 0.05$

dROM (µg H_2O_2/mL) (mean ± SE)



CON-*low*: n = 18

CON-*high*: n = 5

IM-*low*: n = 18

IM-*high*: n = 5

dROM values were not affected by IM

⇨ comparable with earlier studies (Schuh et al. 2019; Ma et al. 2024)

Group G: *n.s.*
Time T: *n.s.*
G x T: *n.s.*
Random: cow and lact. no.

* $p < 0.05$

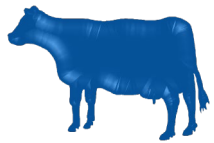
Conclusion

Metabolic response of early-lactating cows to IM varies:

⇨ Cows **without** indicators of lipolysis do not need an IM strategy.

⇨ Cows **with** indicators of lipolysis seem to profit from IM.

Oxidative status was not affected by IM.



Incomplete milking in early lactation

- ✓ **Potential to relieve metabolism**
- ✓ Individual strategy possible

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Quelle: A. Heymann

Thanks to

to the Staff of the

- Institute of Animal Science, and
- Research Station Campus Frankenforst

The research project was funded by the Inter-Departmental Center of Sustainable Agriculture (USL) of the Ministry of Agriculture and Consumers' Affairs of the State of North Rhine-Westphalia, Düsseldorf, Germany.

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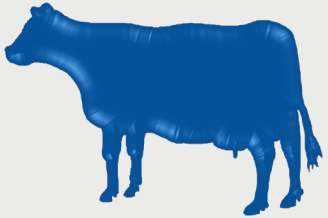


Thank you for your attention

Appendix

Blood serum

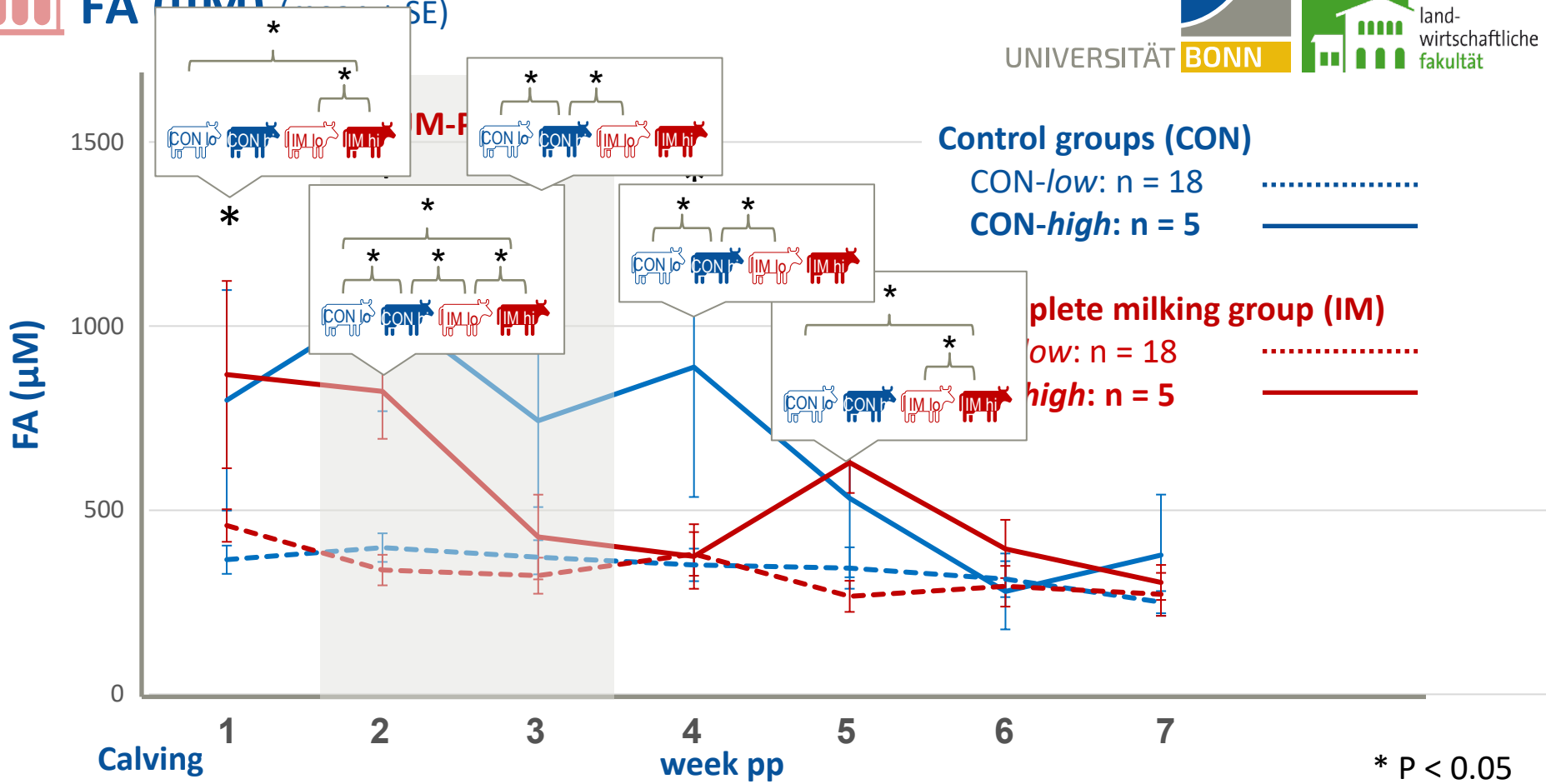
	Methods
Fatty acid (FA)	automatic photometric analyzing system (Eurolyser, Type VET CCA, Salzburg, Austria)
ß-Hydroxybutyrate (BHB)	automatic photometric analyzing system (Eurolyser, Type VET CCA, Salzburg, Austria)
derivatives of reactive Oxygen Metabolites (dROM)	as described by Sauerwein et al. (2020): with N, N-diethyl-para-phenylendiamine as chromogenic substrate (Alberti et al., 2000) with modifications according to Regenhard et al. (2014)

Statistical analyses

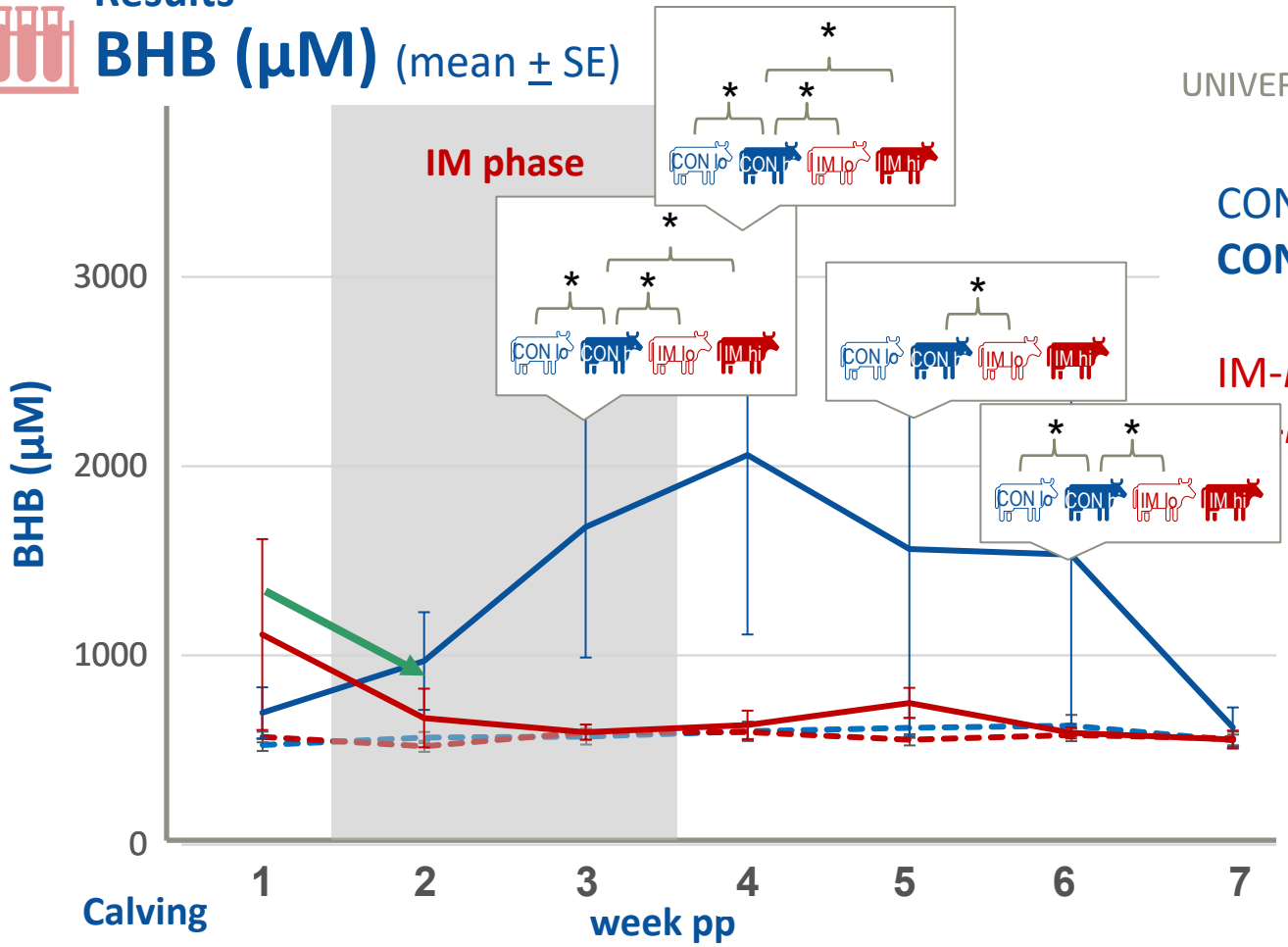
- IBM SPSS Statistics V 29.0
- Data presented as mean ± SE
- Linear mixed model with repeated measures
  Fixed effects: Groups (G), time (T), interaction G x T
  Random effect: Cow, lactations no. (age)
  Multiple comparison based on estimated rand means
- Pairwise comparison with Mann-Withney-U-Test

- P-Value: signifikant (*): $p \leq 0.05$, trend: $0.10 > p > 0.05$

FA (µM) (…SE)


FA (µM)
1500
1000
500
0
1
2
3
4
5
6
7
Calving
week pp
Control groups (CON)
CON-*low*: n = 18
CON-*high*: n = 5
…plete milking group (IM)
…*low*: n = 18
…*high*: n = 5
CON lo
CON hi
IM lo
IM hi
* P < 0.05

BHB (µM) (mean ± SE)



CON-*low*: n = 18

CON-*high*: n = 5

IM-*low*: n = 18

IM-*high*: n = 5

Mixed model:
Group G: p < 0.001
Time T: p < 0.001
G x T: p < 0.001
random: cow and lact. no.

* *p* < 0.05

BFT measurement

The BFT measurement was done above the *M. longissimus dorsi*, right side, and perpendicular to the spinal cord between the 12th and 13th rib and at the 5th lumbar vertebra (Bruckmaier et al., 1998a,b) by ultrasound (LOGIQ V2; GE Healthcare GmbH, Solingen, Germany) using an endolinear probe (5–10 MHz; LK760-RS, GE Healthcare GmbH) at 9 MHz and 7 cm depth.

Detailed clustering of the cows

⇨ indicators of high lipolysis

	high cows n = 10	*low* cows n = 36	P-value (Mann-Whitney-U)
FA week 1 or 2 pp	≥ 800 µM	< 800 µM	-
BFT ap	1.6 ± 0.2 cm	1.3 ± 0.1 cm	n.s.
BFT week 2 pp	1.0 ± 0.1 cm	1.2 ± 0.1 cm	n.s.
delta BFT to ap	- 24.8 ± 10.4 %	+ 3.6 ± 9.2 %	0.049
MR Feed intake (kg/d)	33.0 ± 1.1	37.1 ± 0.5	< 0.001
Milk yield (kg/d)	28.8 ± 0.6	27.8 ± 0.4	n.s.

FA = Fatty acid
BFT = Back fat thickness
MR = Mixed ration

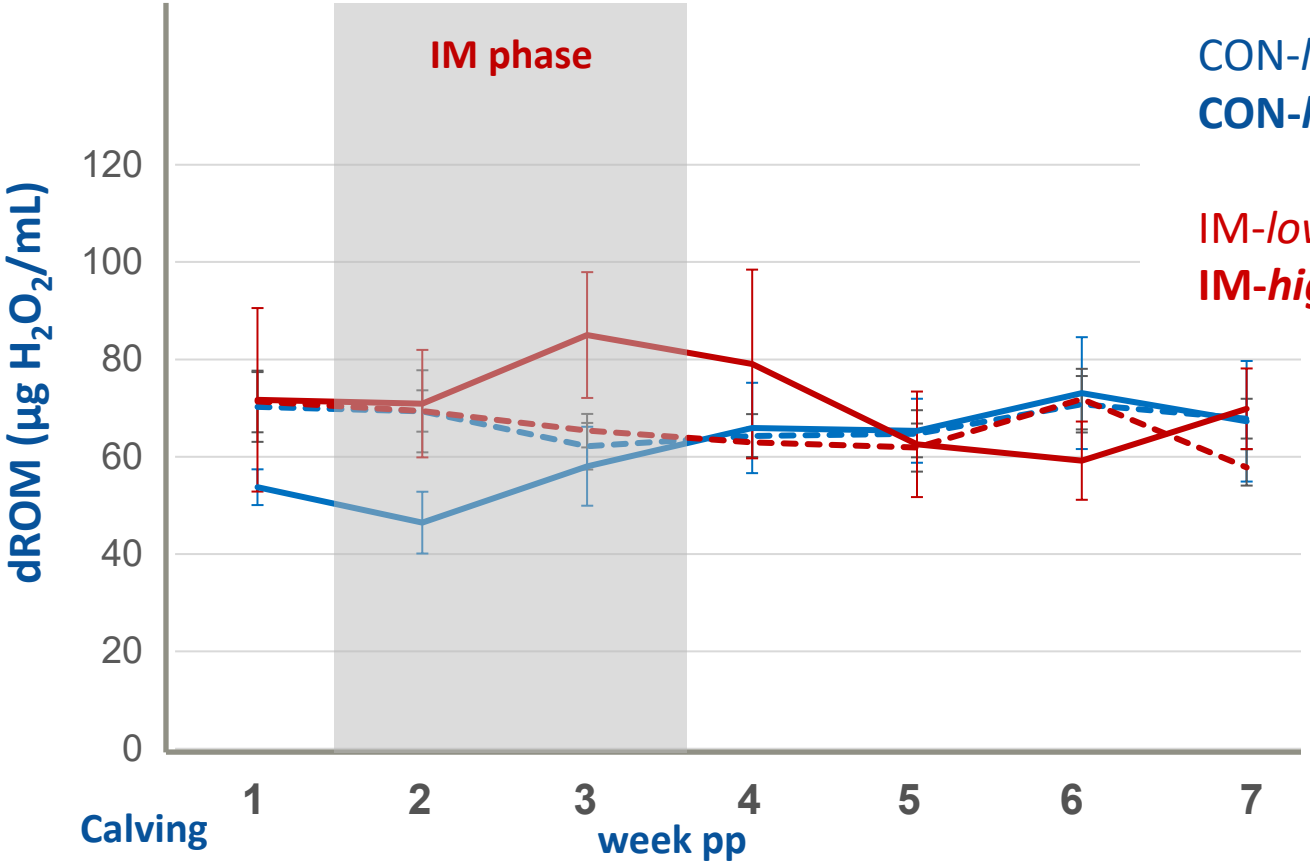
Detailed clustering of the cows

⇨ indicators of high lipolysis

	high cows n = 10	*low* cows n = 36	P-value (Mann-Whitney-U)
FA week 1 or 2 pp	≥ 800 µM	< 800 µM	-
BFT ap	1.6 ± 0.2 cm	1.3 ± 0.1 cm	n.s.
BFT week 2 pp	1.0 ± 0.1 cm	1.2 ± 0.1 cm	n.s.
delta BFT to ap	- 24.8 ± 10.4 %	+ 3.6 ± 9.2 %	0.049
BCS ap	3.45 ± 0.10	3.38 ± 0.05	n.s.
BCS week 2 pp	3.30 ± 0.08	3.19 ± 0.05	n.s.

FA = Fatty acid
BFT = Back fat thickness

dROM (µg H_2O_2/mL) (mean ± SE)



CON-*low*: n = 18

CON-*high*: n = 5

IM-*low*: n = 18

IM-*high*: n = 5

Mixed model:
Group G: n.s.
Time T: n.s.
G x T: n.s.
Random: cow and lact. no.

* $p < 0.05$