DEPARTMENT OF ANIMAL SCIENCE
AARHUS UNIVERSITY

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PROTEIN DEFICIENCY AND ITS EFFECTS IN PERIPARTURIENT DAIRY COWS

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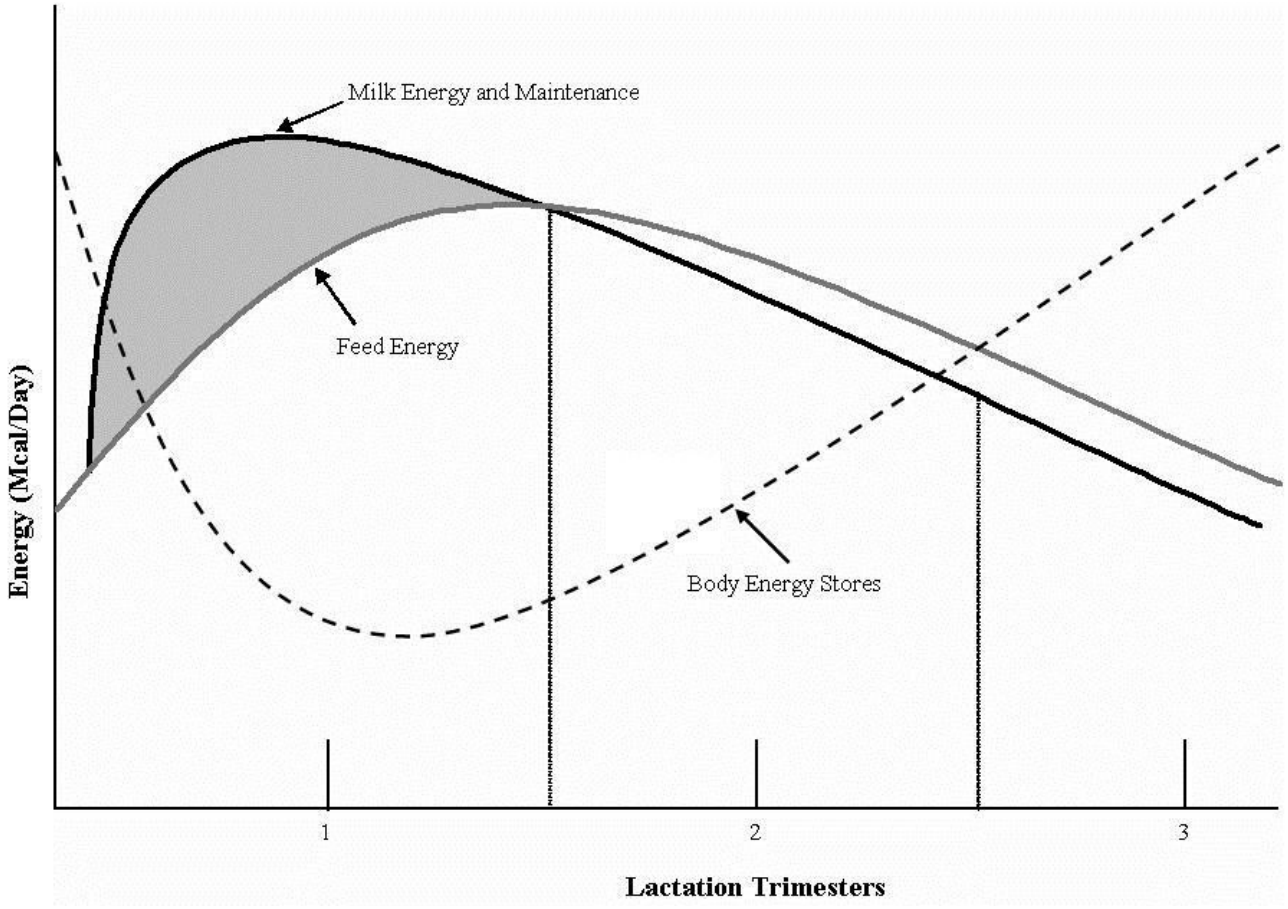
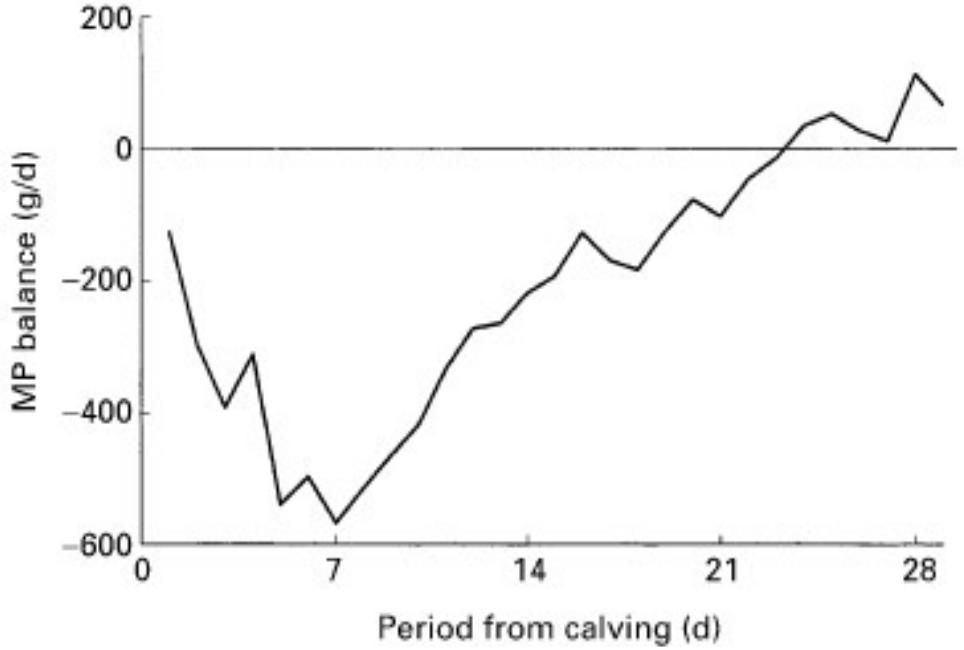
THE OVERALL POSTPARTUM SITUATION – NEGATIVE ENERGY BALANCE



POSTPARTUM PROTEIN DEFICIENCY

Great focus on postpartum fat mobilisation

› Contrastingly little focus on protein mobilisation



Bell et al., 2000

FOCUS ON AMINO ACID SUPPLY

Aim

› Increase AA availability in peripheral tissues

Overall hypothesis

› The postpartum protein deficiency limits performance

› Production and metabolic stress

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2 METABOLIC EXPERIMENTS

- 1 IN FOULUM
- 1 IN CANADA

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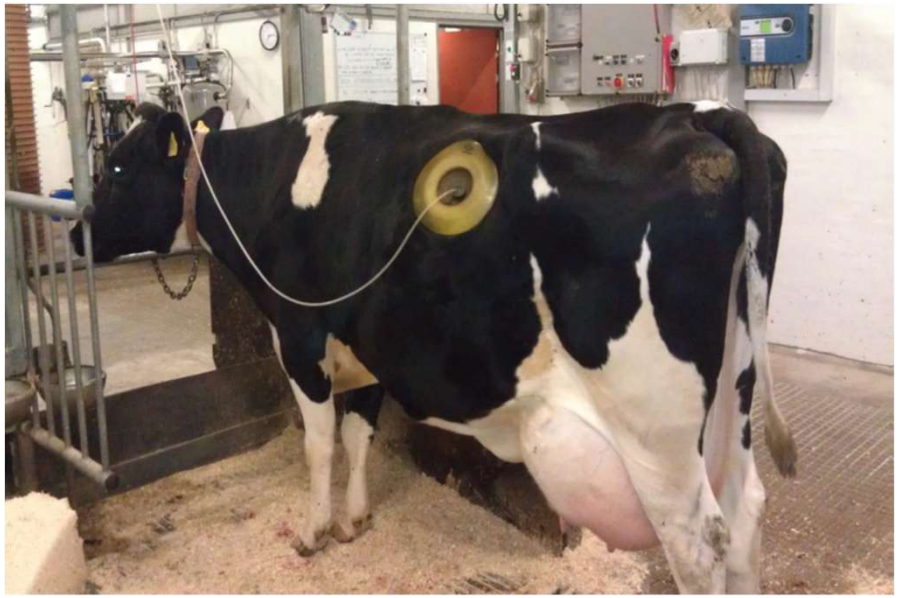
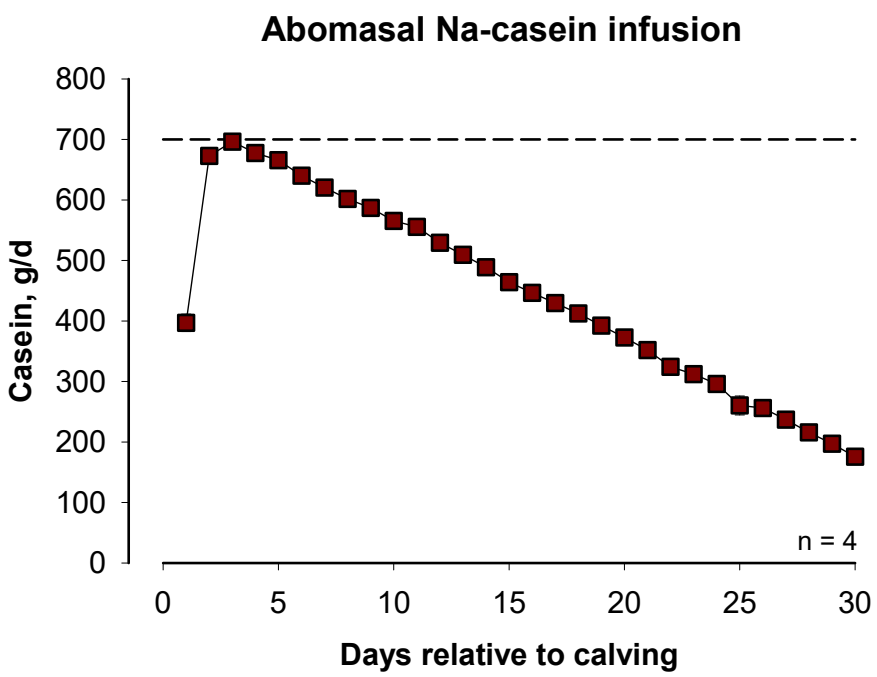
ABOMASAL INFUSION OF PROTEIN



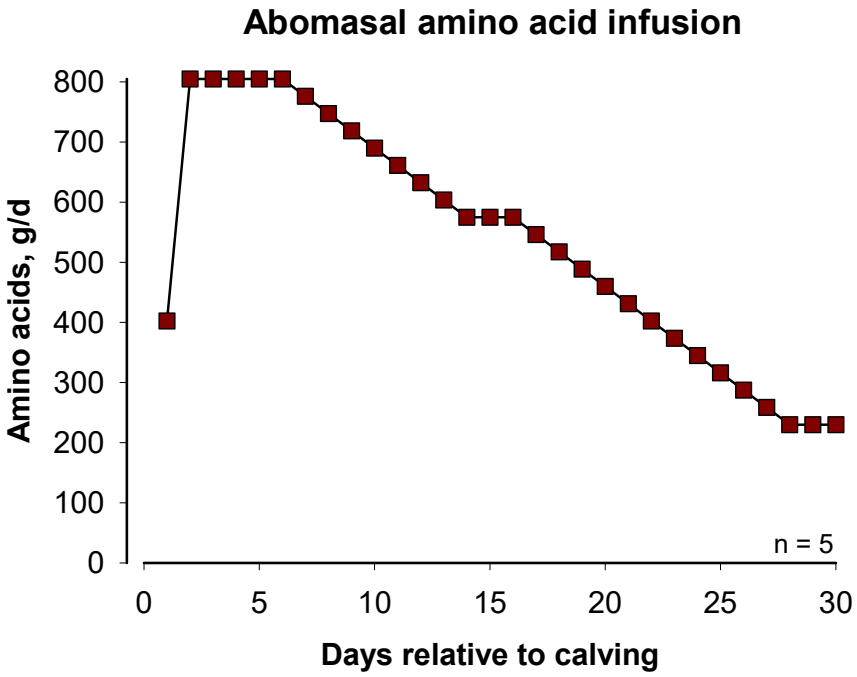
INFUSION OF PROTEIN OR WATER

Foulum exp., 4 cows



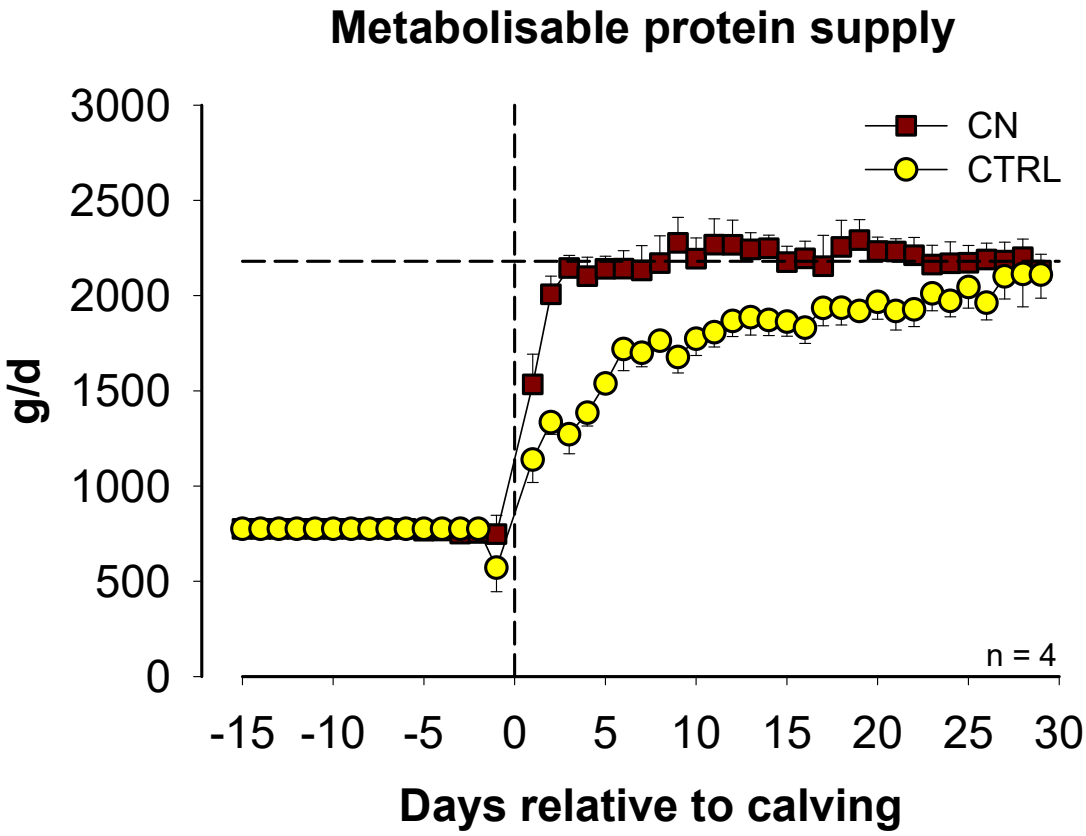
Basal diet: 15.9% CP

Canadian exp., 5 cows



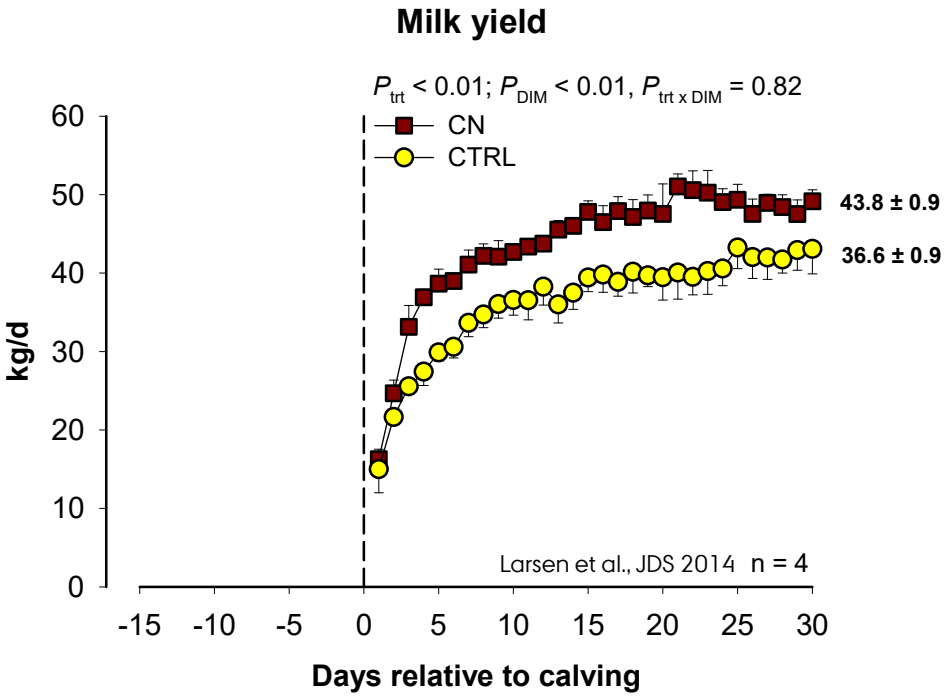
Basal diet: 16.4% CP

"CLOSE THE GAP" STRATEGY

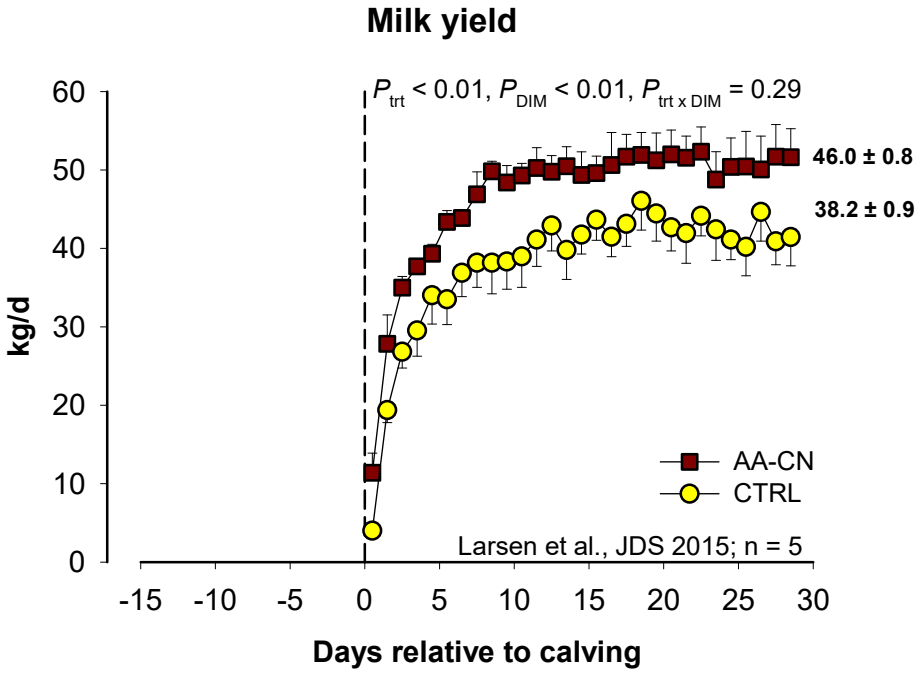


MILK YIELD: +7 TO +8 KG/D

Foulum exp.

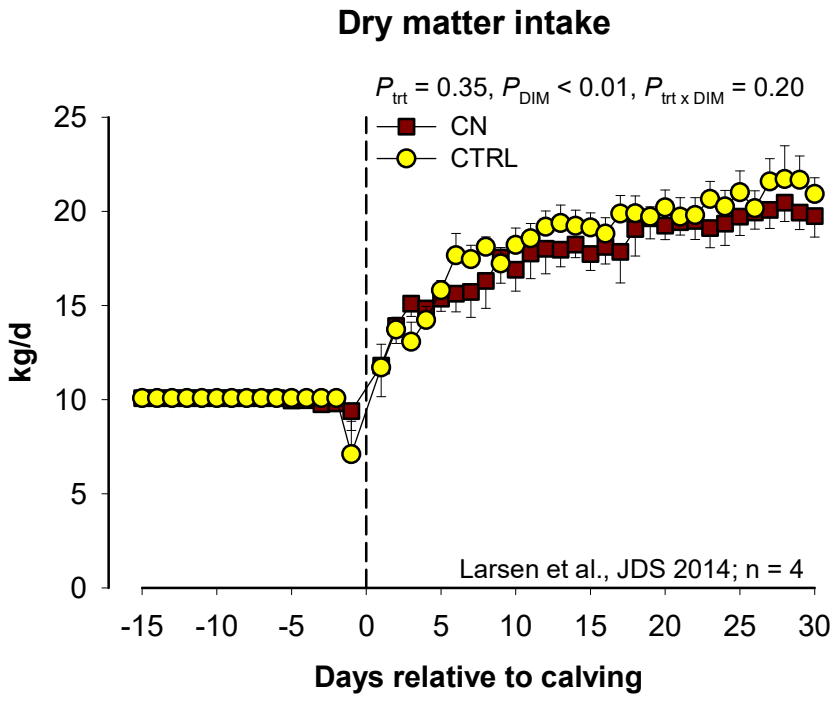


Canadian exp.

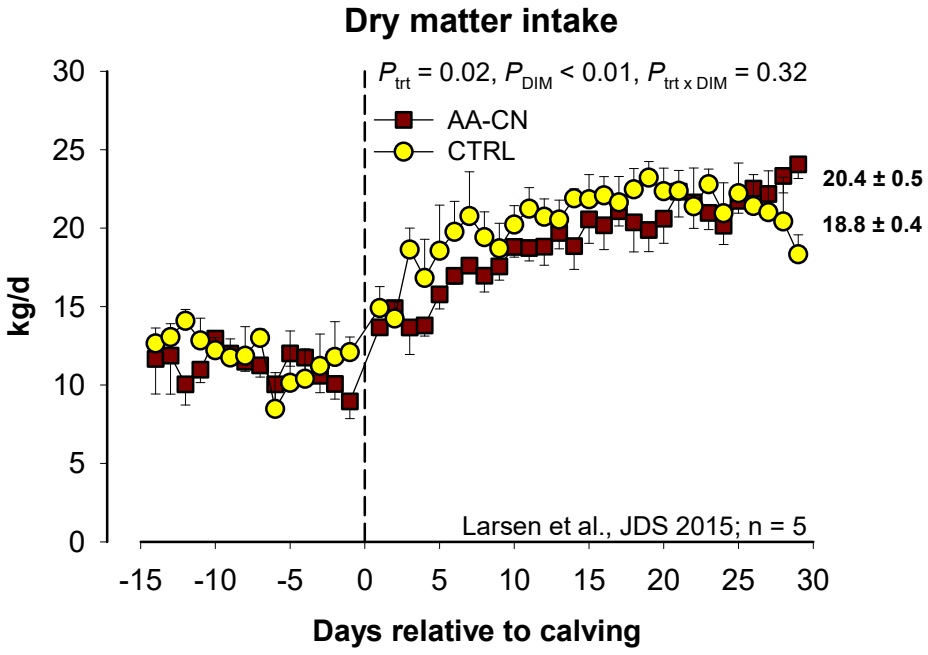


FEED INTAKE

Foulum exp.

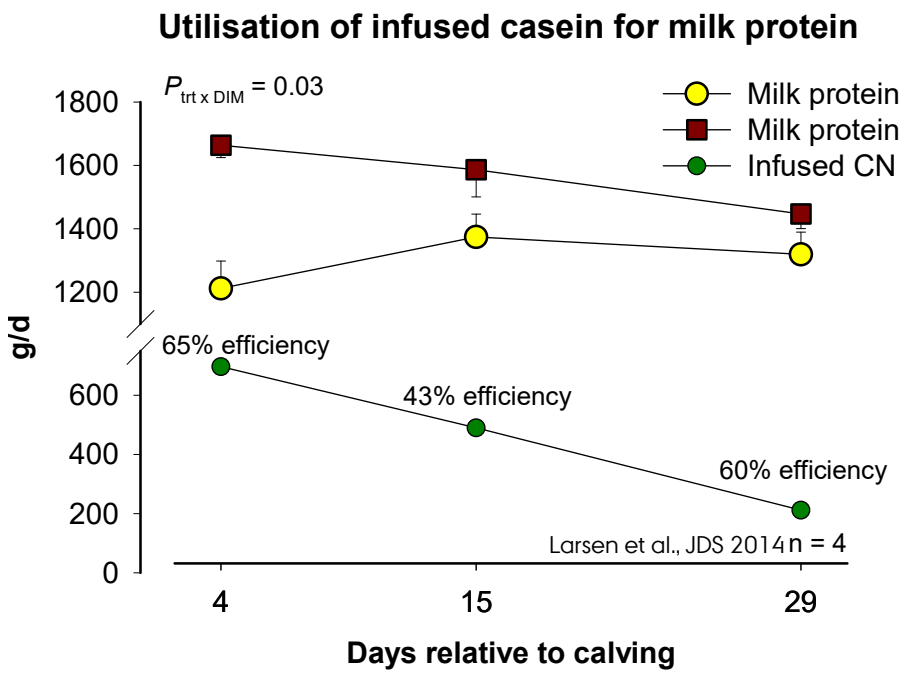


Canadian exp.

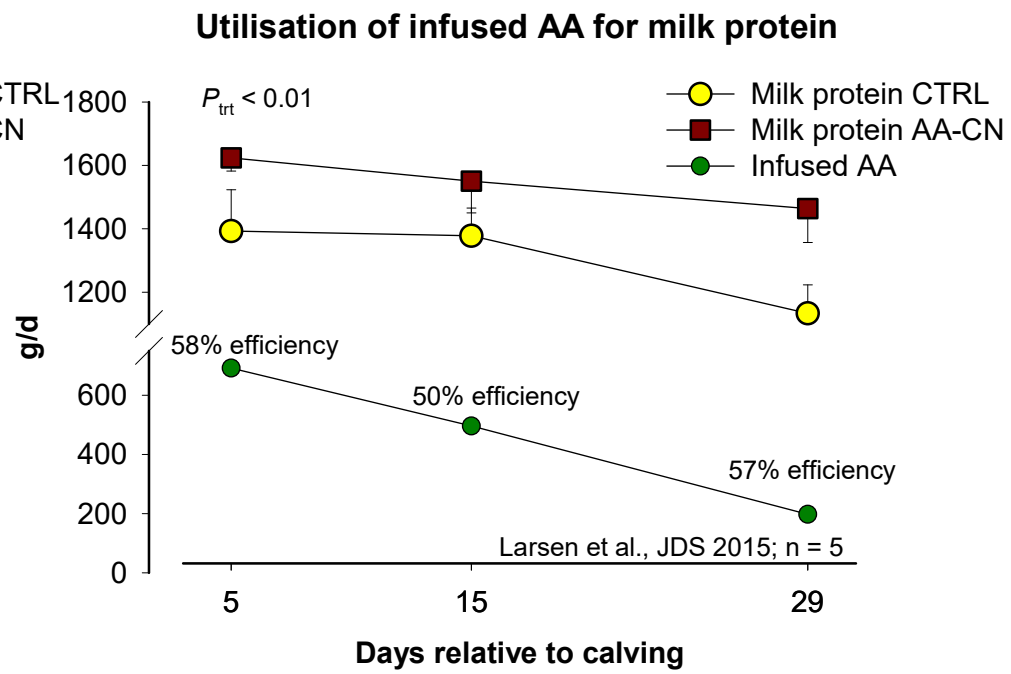


HIGH MARGINAL UTILISATION OF ADDITIONAL PROTEIN

Foulum exp.

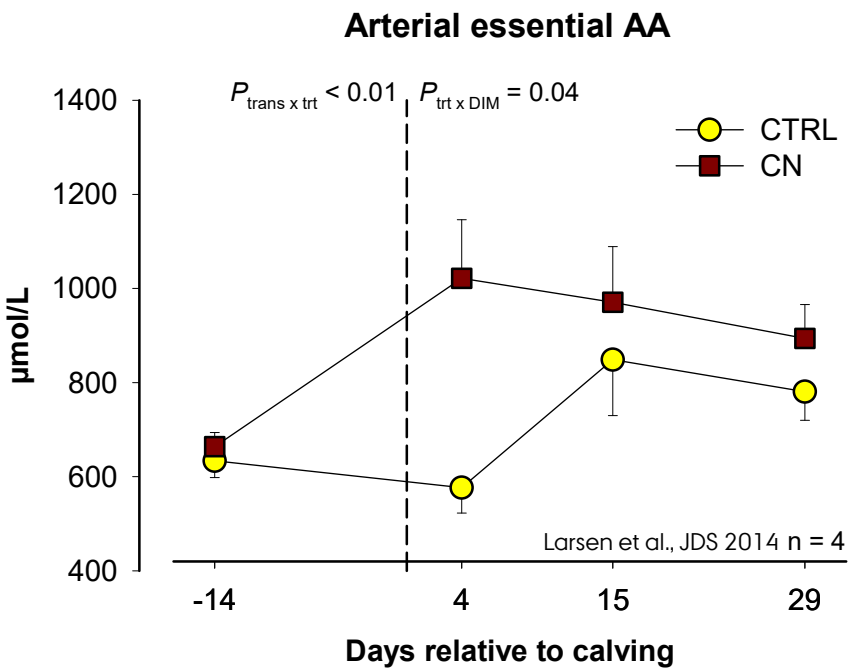


Canadian exp.

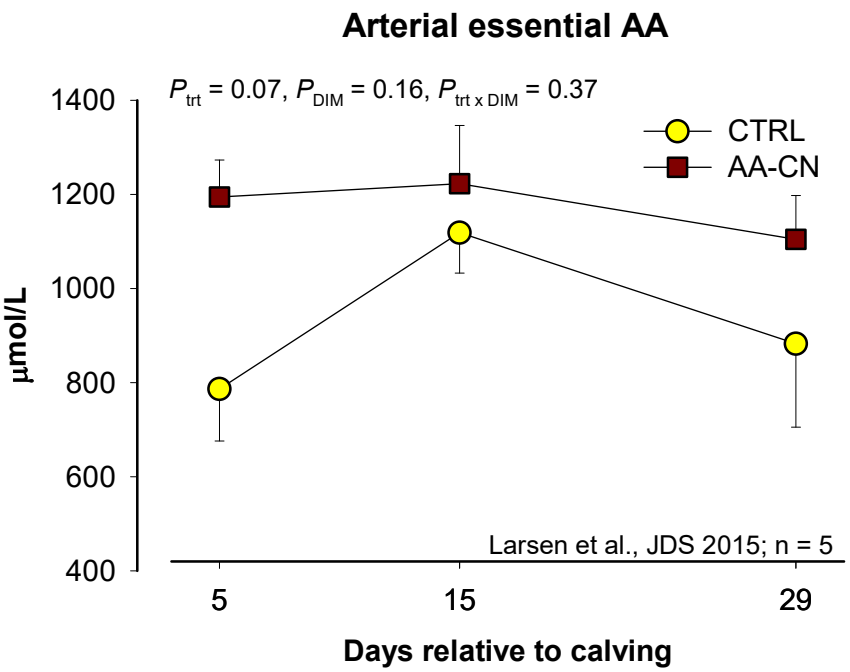


ENHANCED PROTEIN STATUS

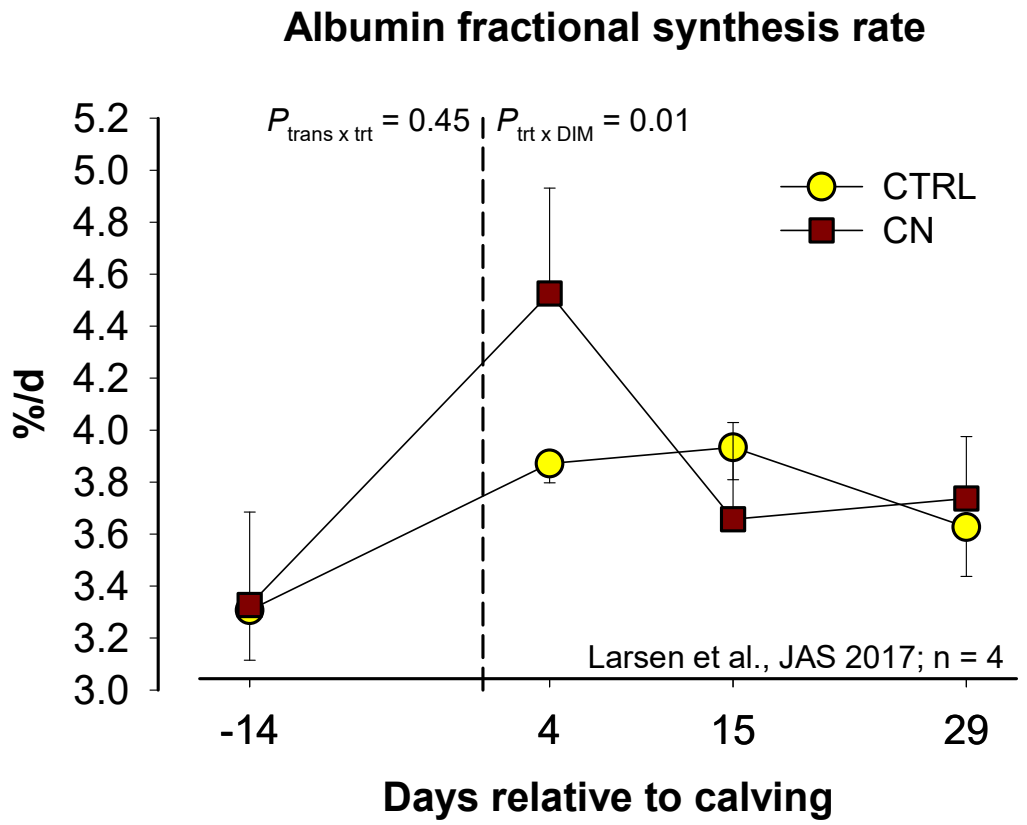
Foulum exp.



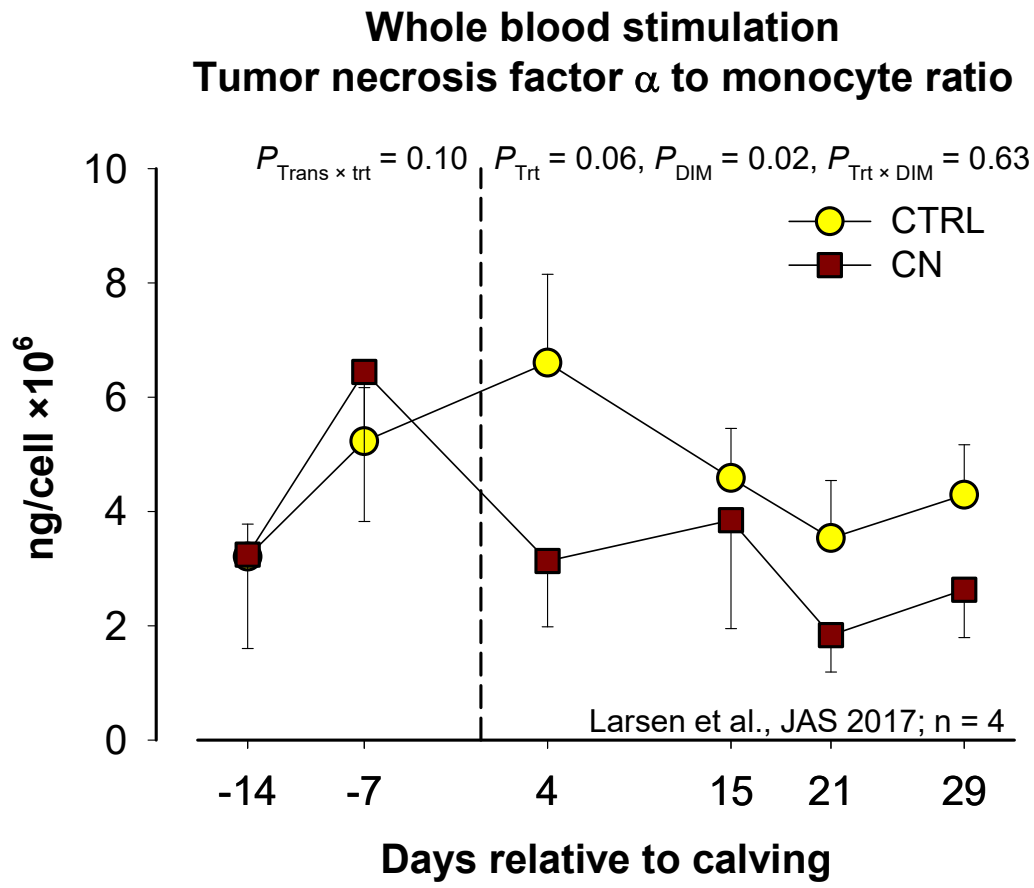
Canadian exp.



GREATER SYNTHESIS OF ALBUMIN

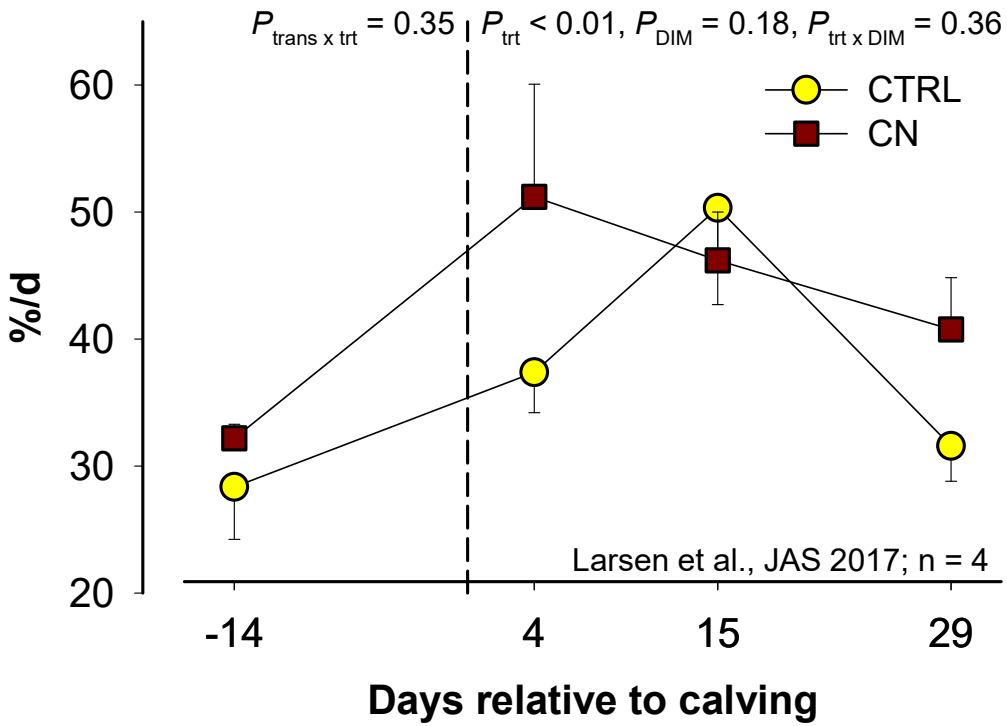


STABILISED IMMUNE RESPONSE



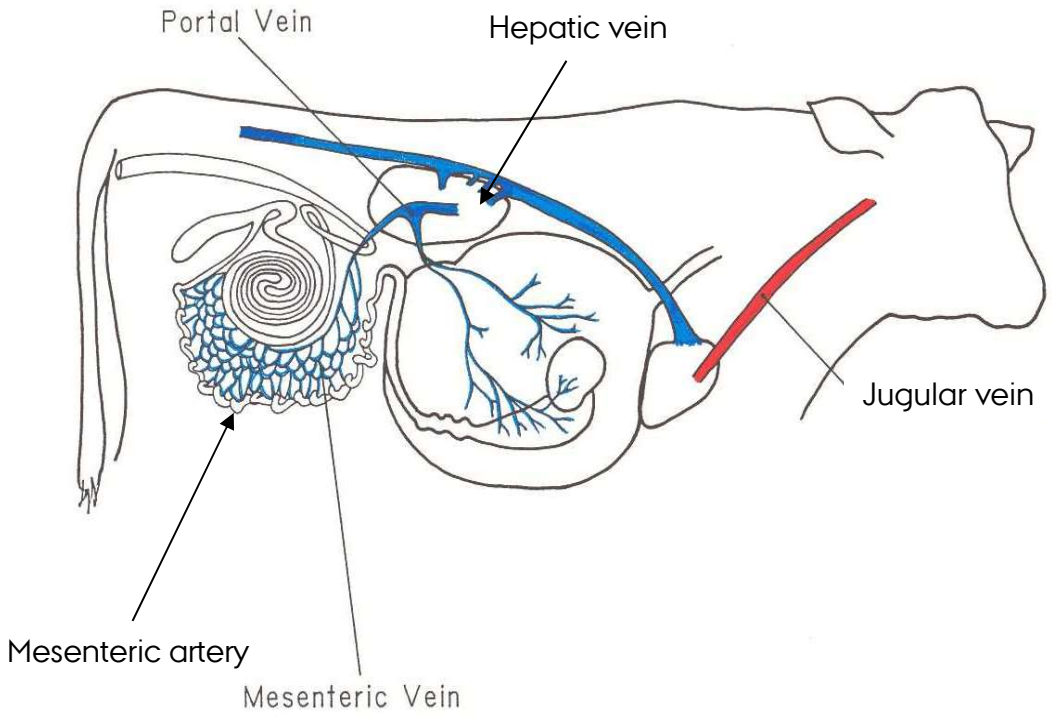
PROLIFERATION OF RUMEN PAPILLAE

Fractional synthesis rate of protein in rumen papillae



> Supported by mRNA expression data

ANIMAL MODEL – CANADIAN EXP.



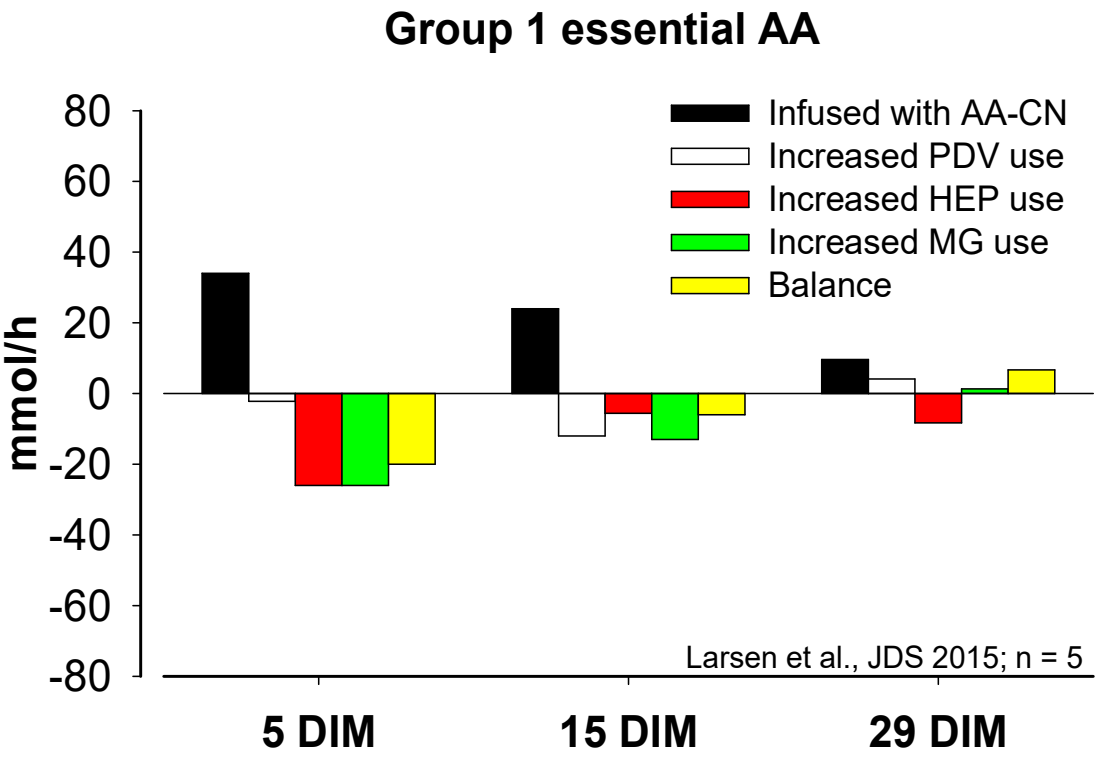
METABOLISM OF ESSENTIAL AA

› Based on established lactations

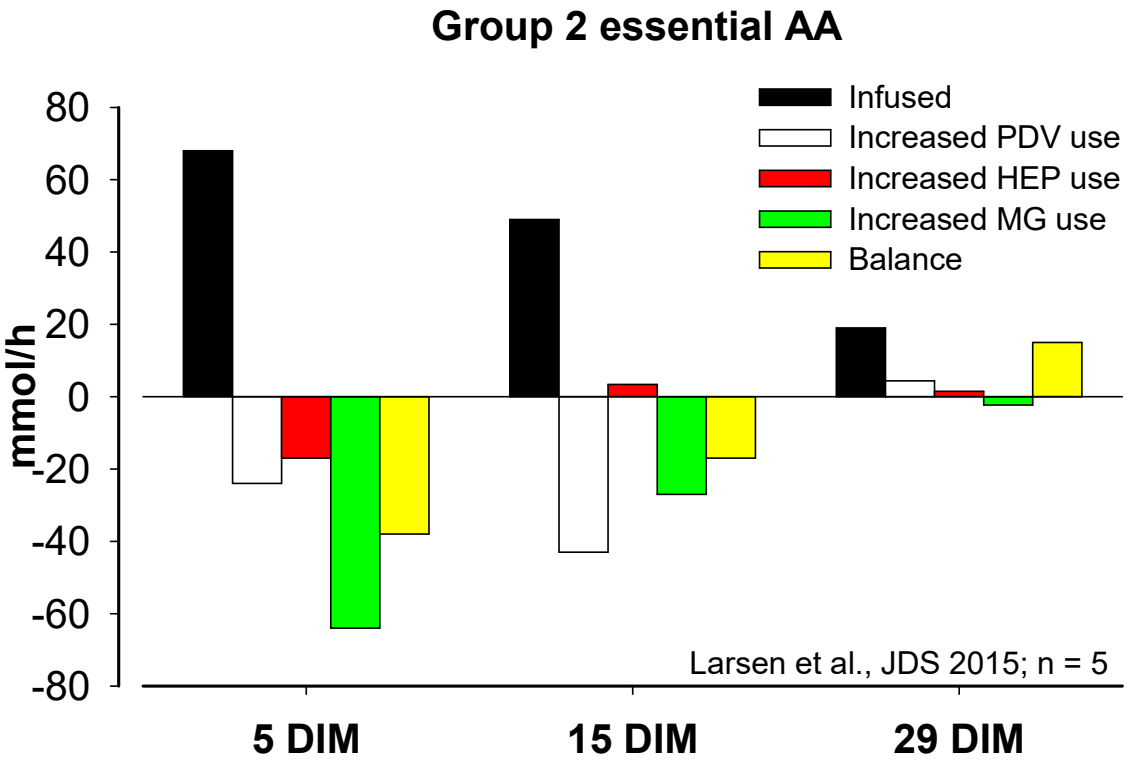
› Group 1 = His+Met+Phe+Tyr+Trp
› 1:1 mammary uptake to release in milk
› Typically net liver uptake

› Group 2 = Ile+Leu+Val+Lys
› Excess mammary uptake to release in milk
› Little to no net liver uptake

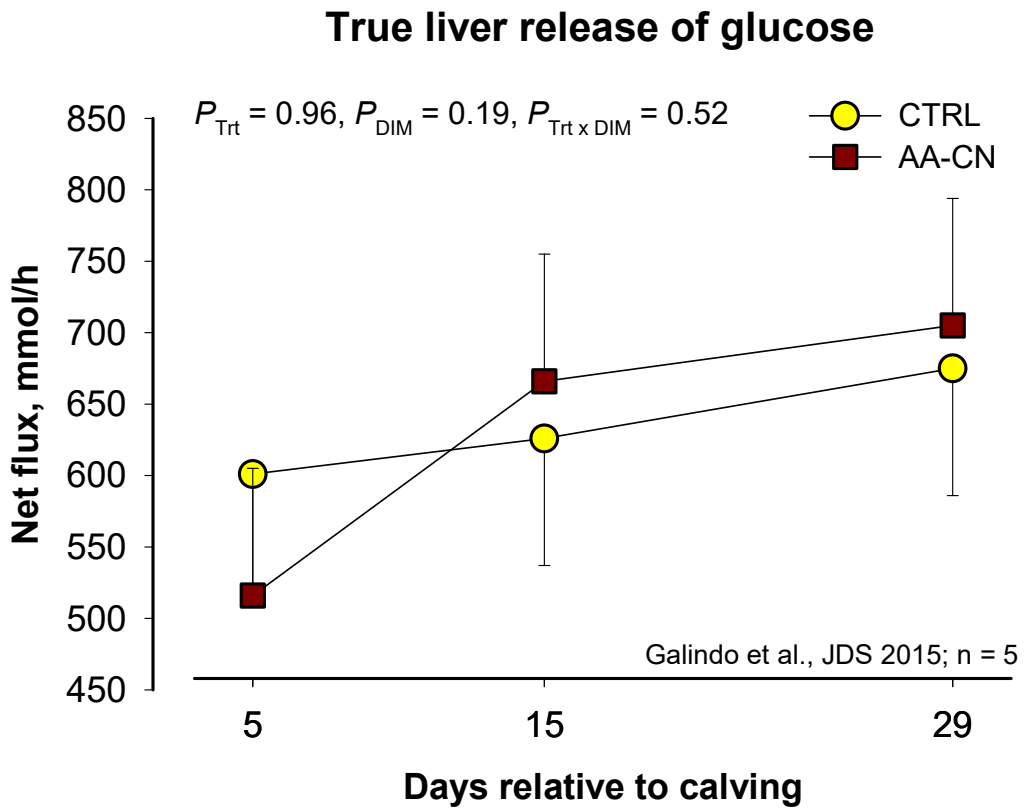
USE OF THE ADDITIONAL AA
GROUP 1 = HIS+MET+PHE+TYR+TRP



USE OF THE ADDITIONAL AA
GROUP 2 = ILE+LEU+VAL+LYS

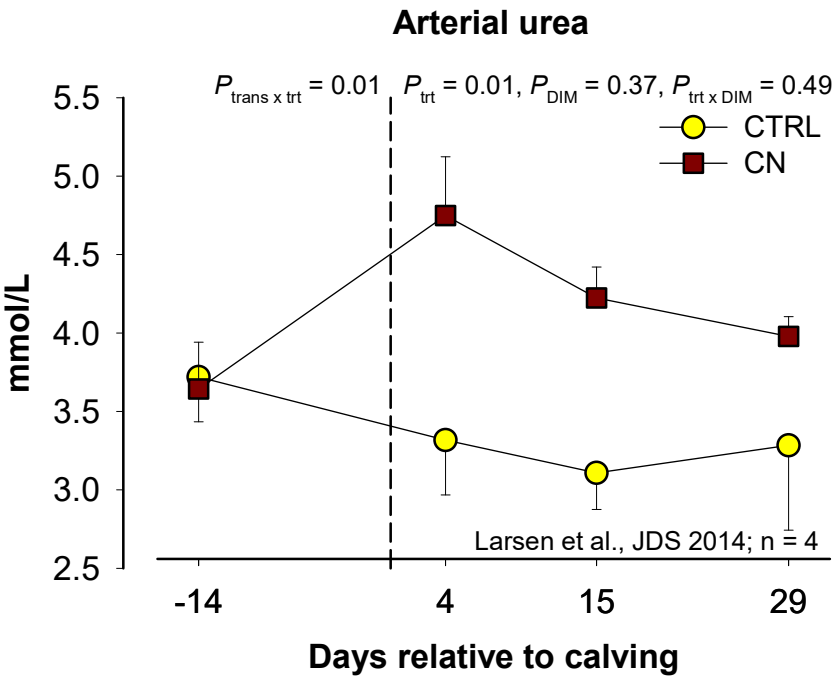


NO INCREASE IN LIVER GLUCOSE RELEASE

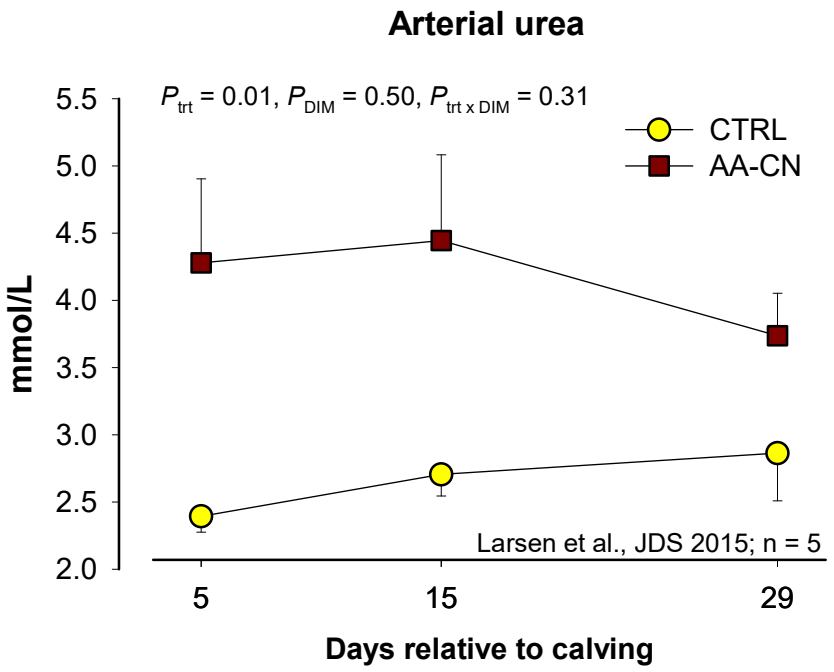


CATABOLISM OF AMINO ACIDS

Foulum exp.

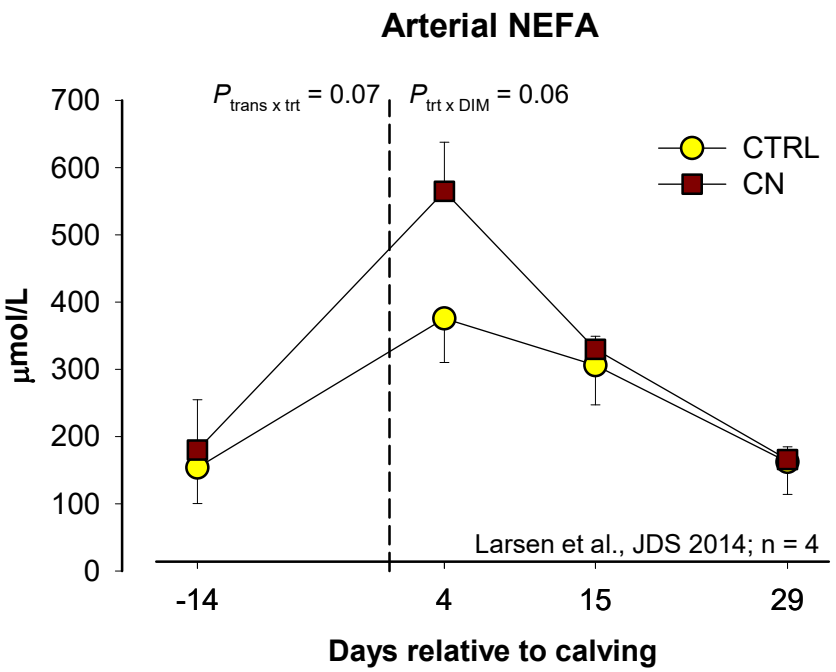


Canadian exp.



FAT MOBILISATION

Foulum exp.



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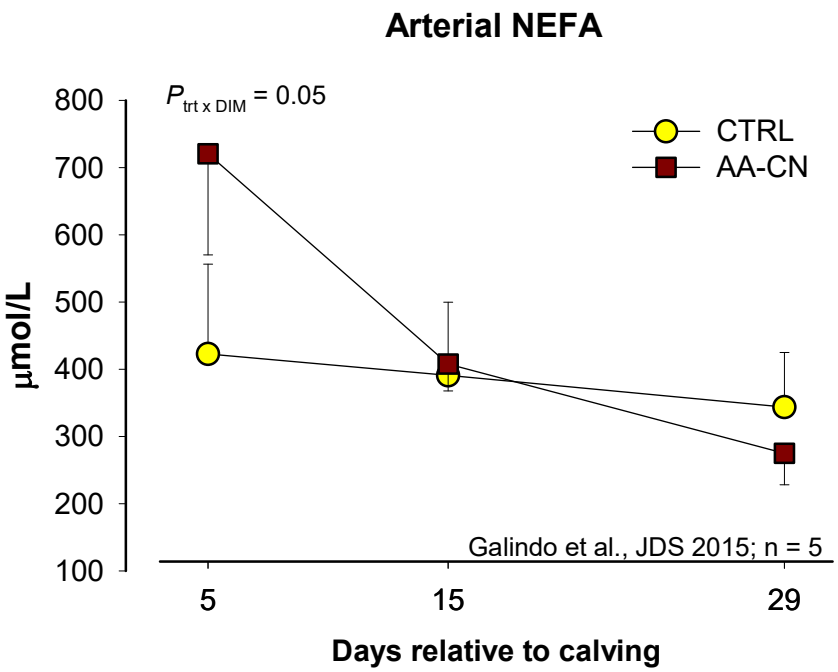

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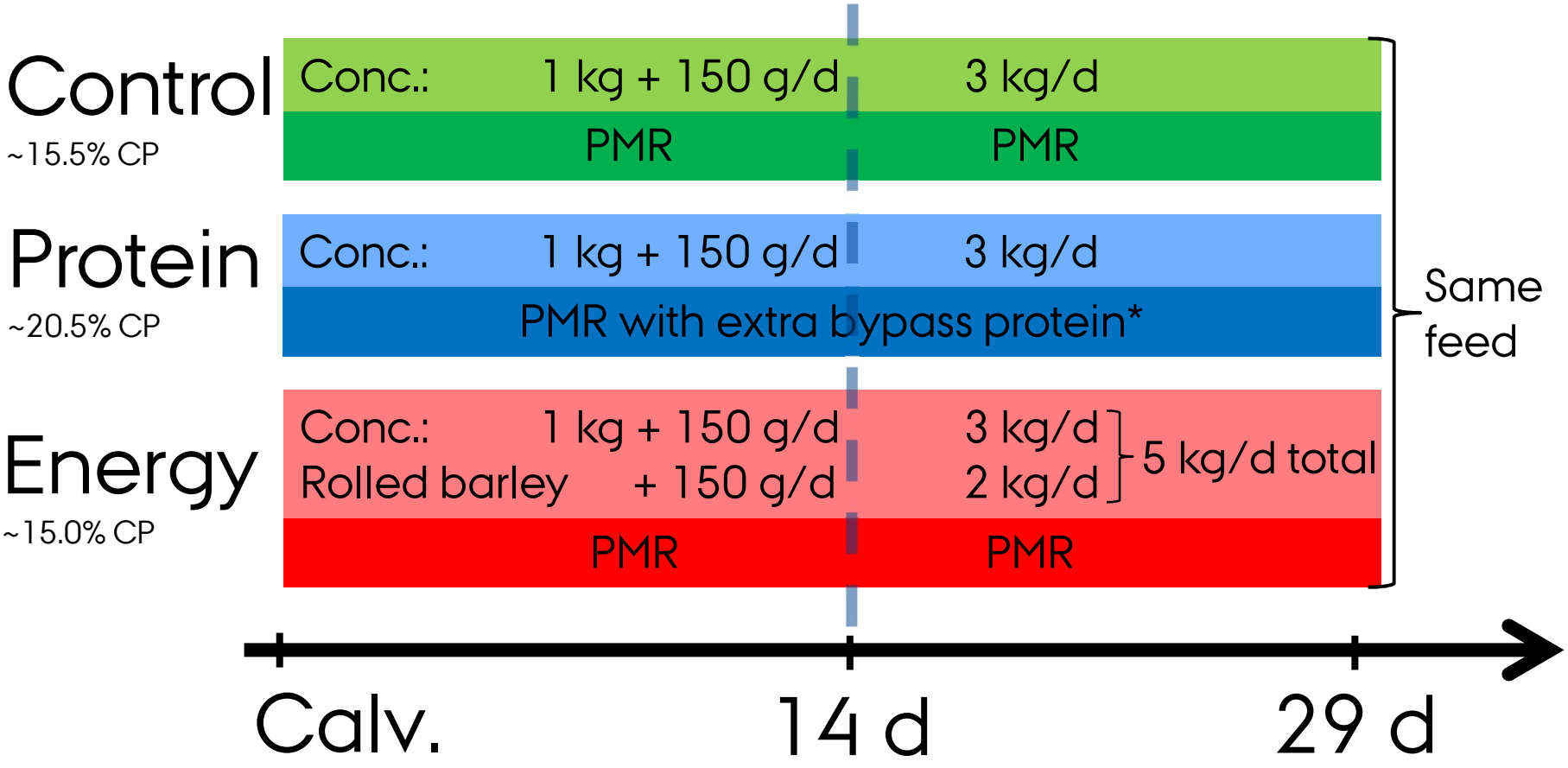
PRODUCTION TRIAL

AUTOMATIC MILKING SYSTEM AND INSENTEC FEEDING GATES

106 HOLSTEINS + 43 JERSEYS RANDOMISED BLOCK DESIGN



Larsen et al., EAAP 2017

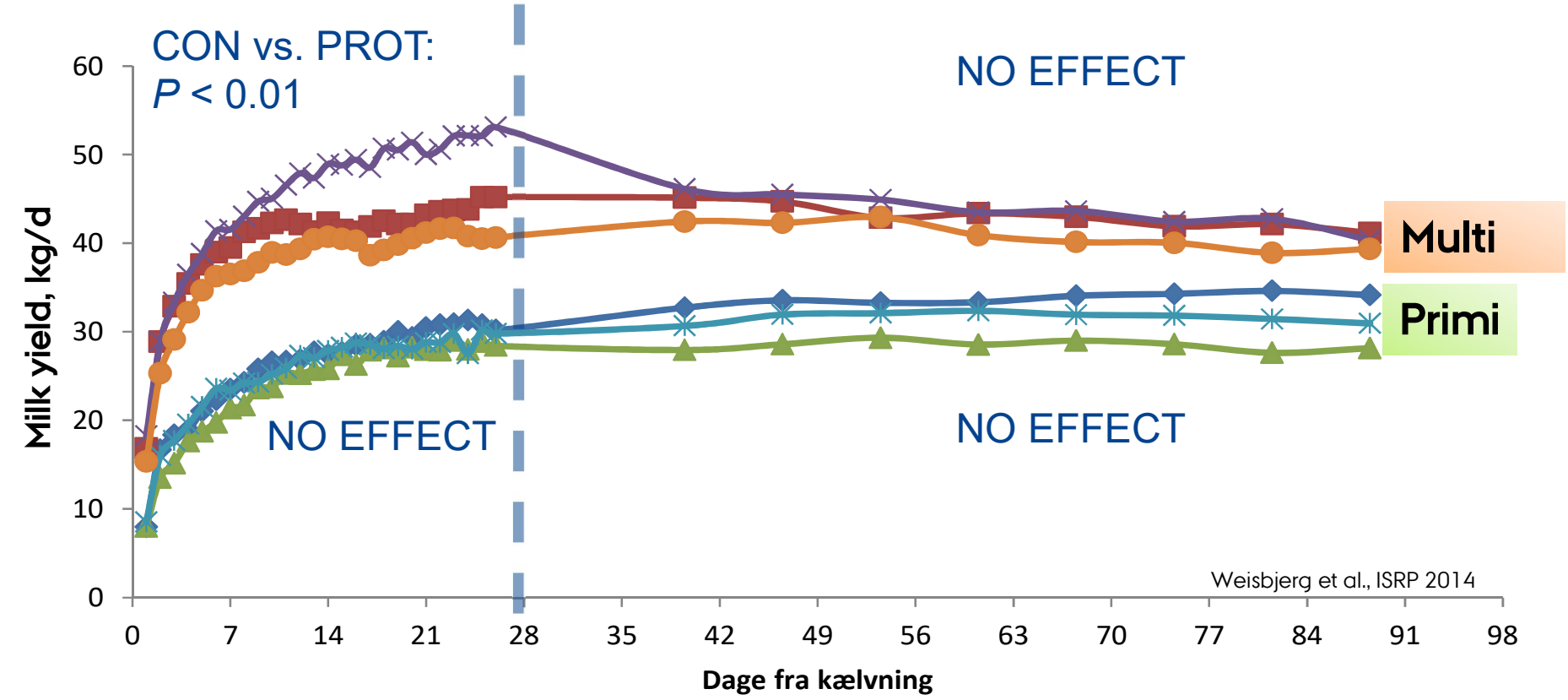
***An equal mix of SoyPass, maize gluten 60, and potato protein to avoid specific ingredient effects**

PROTEIN SOURCES

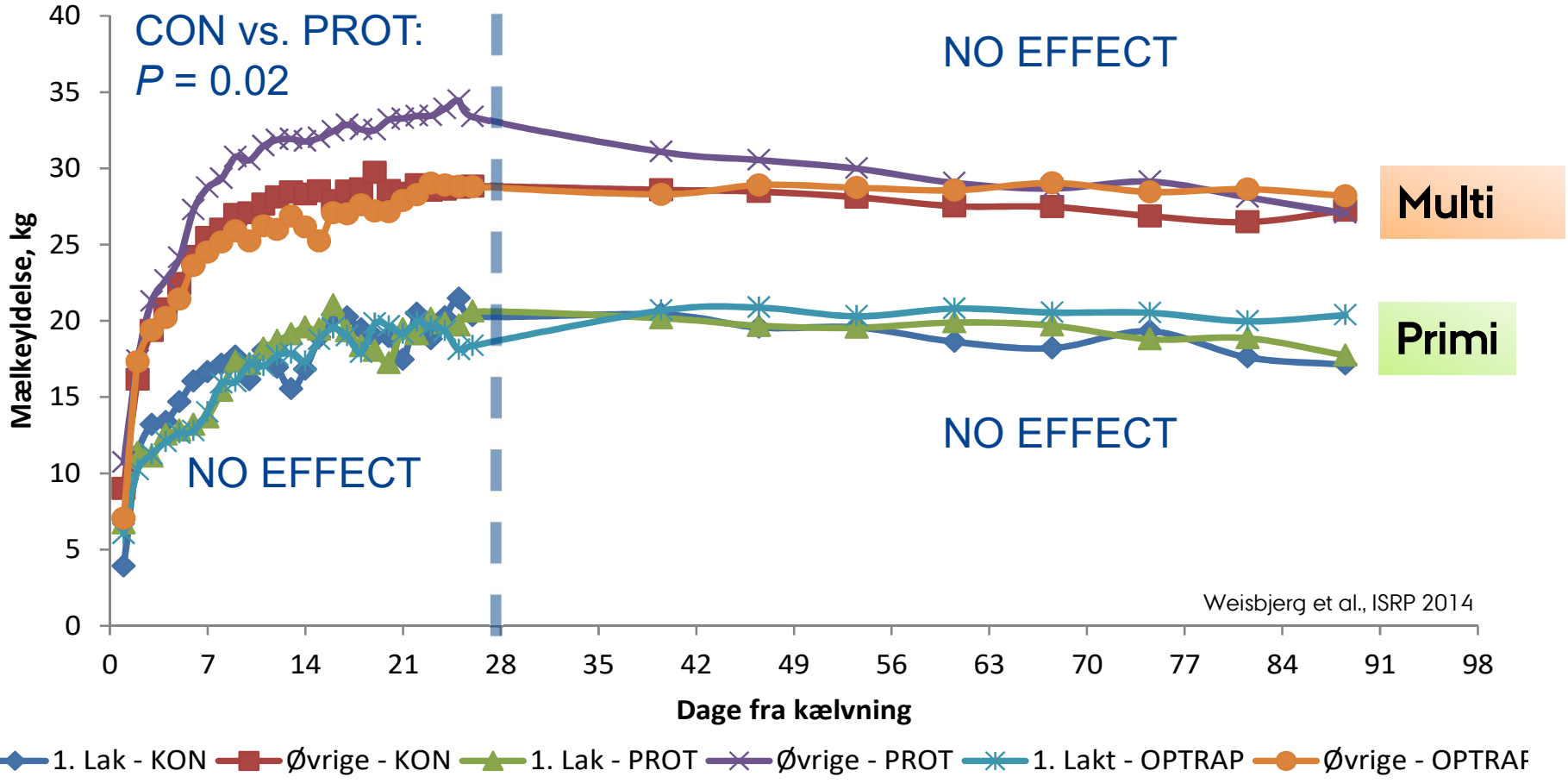
g/kg DM	Soybean meal	SoyPass	Rape meal	RaPass	Sunflower meal	Corn glut. 60%	Potato-protein
CP	528	**490**	389	336	417	**682**	**820**
NDF	102	224	270	237	280	33	65
EPN, %	(55)	(~30)	(65)	(20)	(74)	(23)	(~40)
AAT (MP)	228	**275**	145	187	130	**443**	**382**
PBV	239	122	180	56	235	121	364

(VfL, 2005)

GREATER MILK YIELD IN MULTIPAROUS HOLSTEIN COWS



SAME EFFECT IN JERSEYS



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CONCLUSIONS

CONCLUSION

- Protein appears more limiting than glucose
  - Window of opportunity in the first days after calving
- Biologic potential for greater production
  - Along with stabilised maternal body functions
  - Carry-over effect on production?
  - How long and how much?
  - Protein effect or a selection of essential AA?
- Not associated with greater feed intake
  - >>> increased fat mobilisation – a problem?
  - >>> where does the nutrients come from?
  - >>> should glucose supply be increased?

CURRENT ACTIVITIES

- Adisseo got EU TransNational Access (SmartCow) funding for a project to be run at Aarhus University

- Transition cow study
- Abomasal infusion of total AA or essential AA only
- Milk yield, feed intake, and mammary uptake of nutrients

- First step in refining the AA requirement in the postpartum period

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THANK YOU FOR THE ATTENTION

FUNDING

DANISH COUNCIL FOR INDEPENDENT RESEARCH
THE DANISH AGRI-FISH AGENCY
DANISH MILK LEVY FUND
CANADIAN CANOLA COUNCIL