COLLEGE OF AGRICULTURE AND LIFE SCIENCES
SCHOOL OF ANIMAL SCIENCES
VIRGINIA TECH

Osorio Lab

Peripartal supplementation of postbiotics on lactation performance in transition dairy cows

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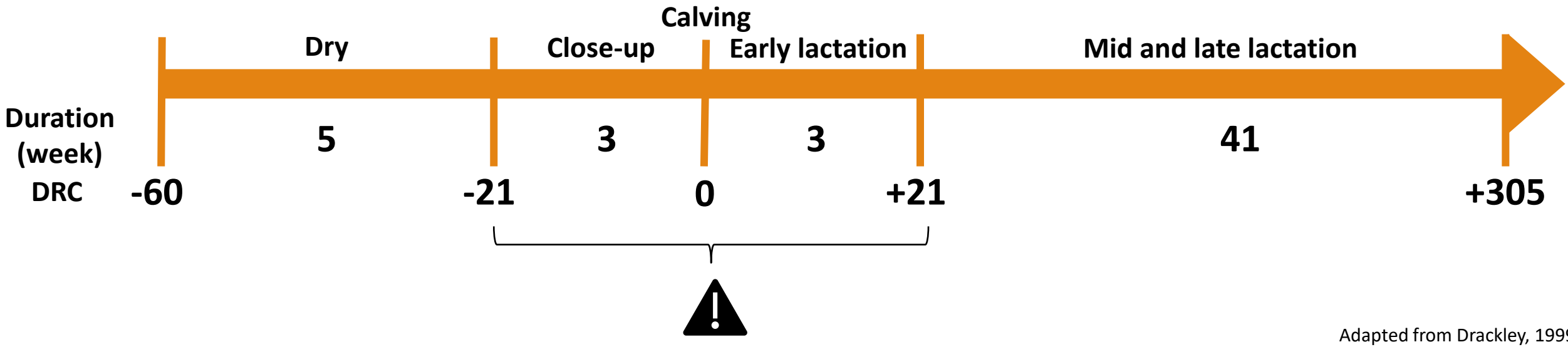
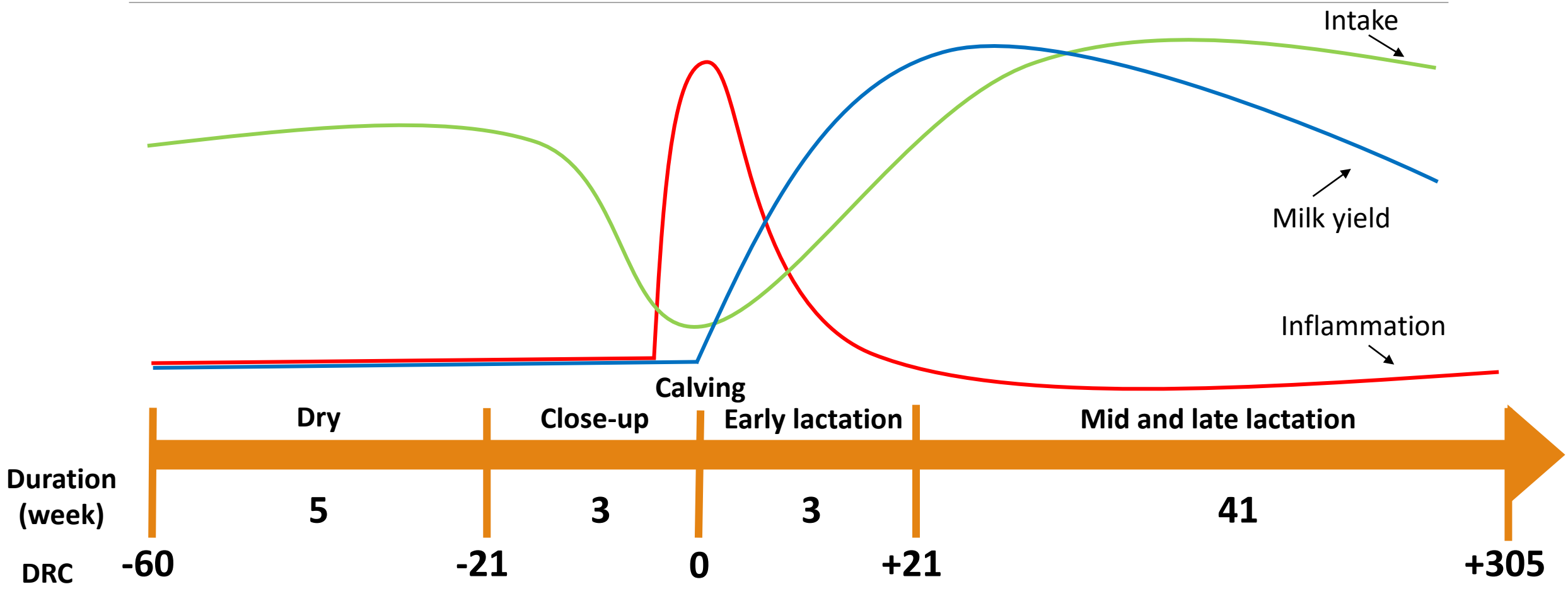
VIRGINIA TECH

Transition period



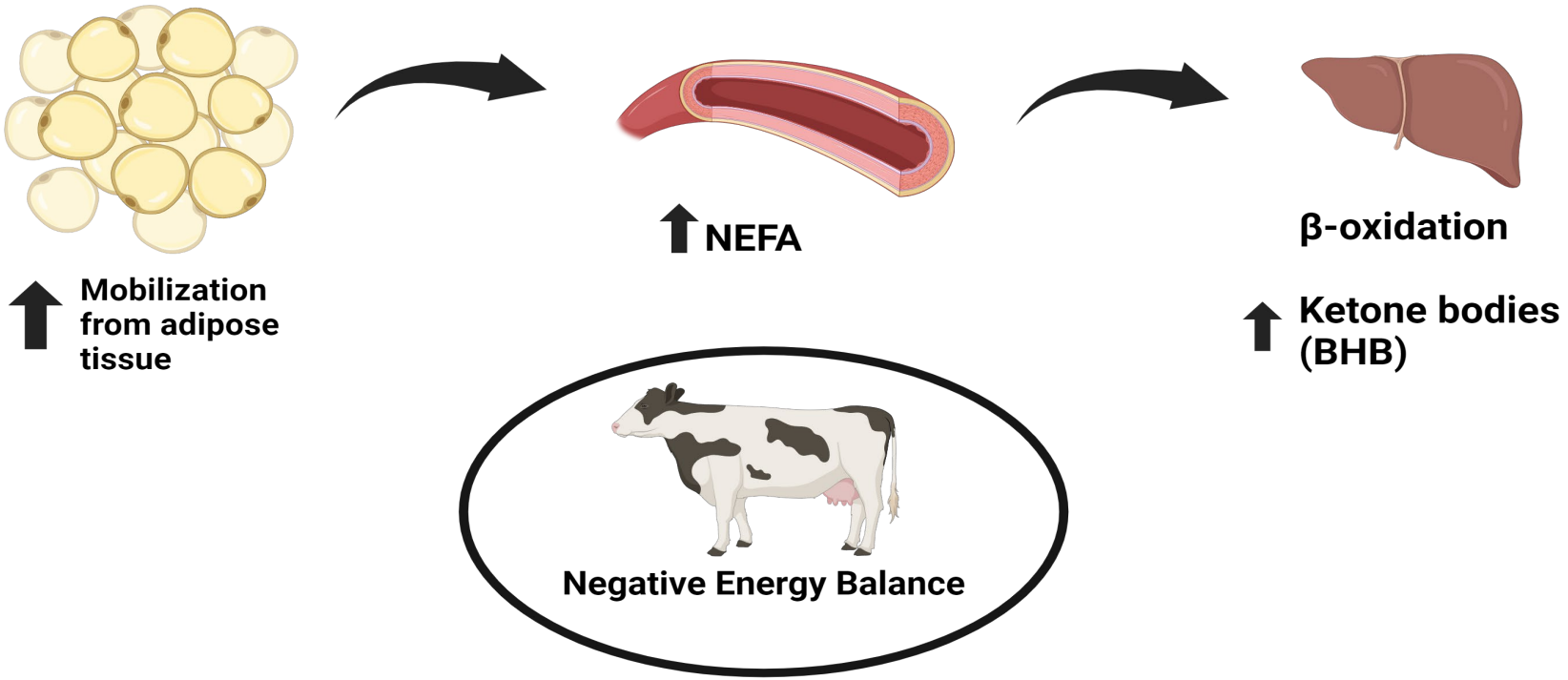
Adapted from Drackley, 1999

Transition period



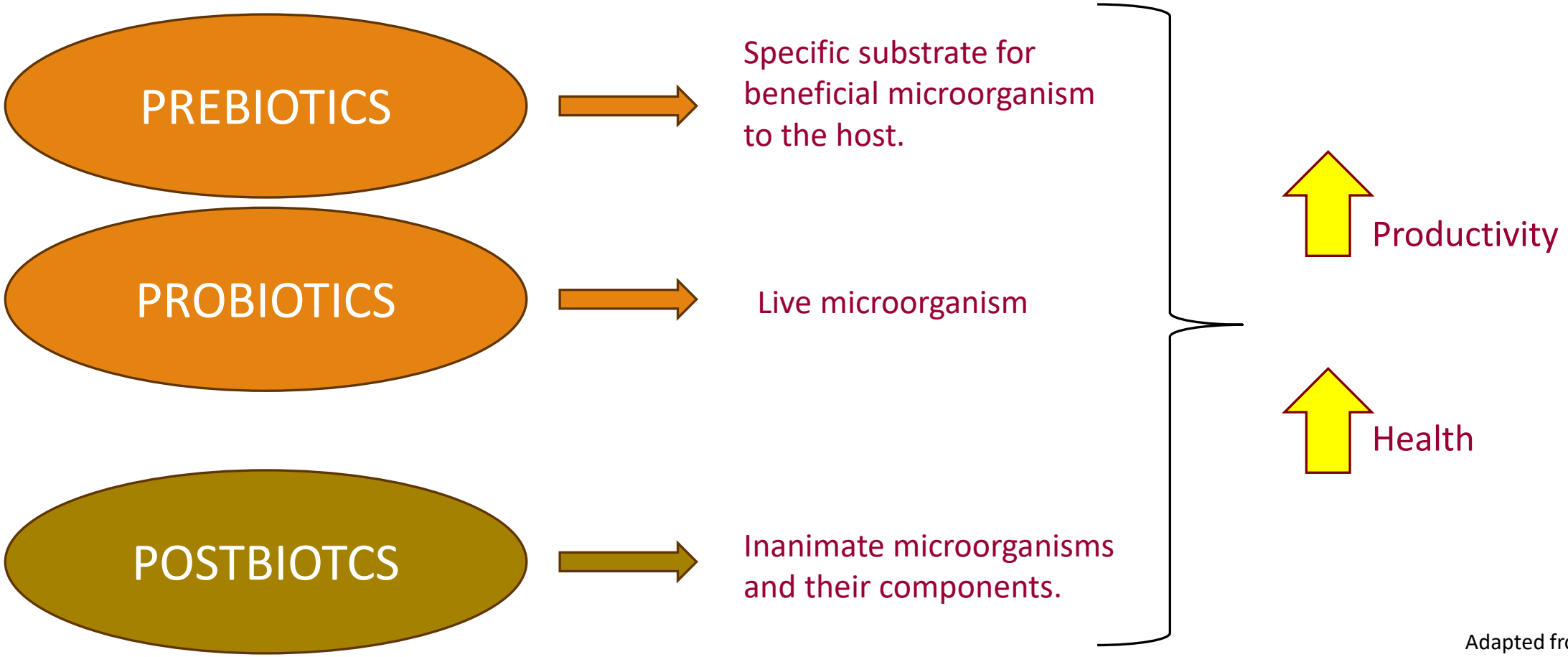
Adapted from Trevisi, 2011

Transition period



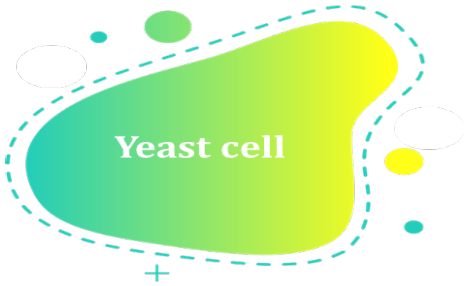
Adapted from Drackley, 1999

Microbial-modulating dietary supplements

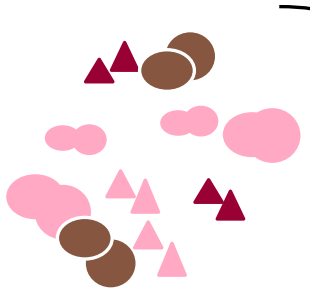


Adapted from Salminen, 2021

Postbiotic



Fermentation



- Organic acids
- Vitamins
- Proteins
- AA

Postbiotic in transitions cows

Positive effects on:

Immune system function

Metabolic profile

Rumen profile fermentation

Opsi et al., 2012; Olagaray et al., 2019; Carpinelli et al., 2021

Objective

Evaluate the effects of a postbiotic prototype on performance, blood biomarkers, and rumen fermentation profile in dairy cows during the transition period until 60 DIM.

Materials and Methods

61 multiparous Holsteins cows (72 enrolled)

VT Dairy Complex (Kentland Farm)

Cows were monitored from -35 to 60 DIM

Animals removed	
Cause	**N**
Twins	4
Clinical hypocalcemia	1
Toxic mastitis	1
Euthanasia	1
Abort	1
Stealing	2
Outlier	1
Total	**11**

Materials and Methods

Experimental period: -35d before predicted calving day → 60 DIM

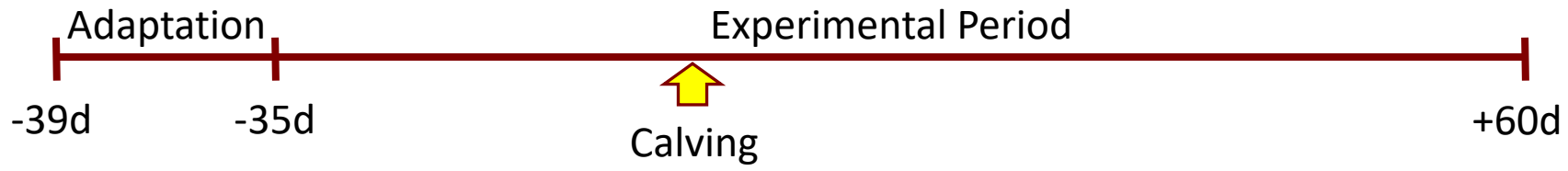
- 4d of adaptation before experimental period

Blocked according to:

Expected calving date

Parity
2.2 ± 1.3

Previous lactation energy-corrected milk
13,625 ± 2,298 kg



Materials and Methods

d-35 - d-22	d-21 – d0	d1 – d30	d31 – d60
FAR-OFF	CLOSE-UP	LACTATION FRESH	LACTATION POST-FRESH

Top-dressed

N = **30**
25g placebo + 100g ground corn
Control (CTL)

N = **31**
25g postbiotic + 100g ground corn
Postbiotic (PB)

Table 1. Basal diets specifications

Nutrient, % of DM	Diets			
	Far-Off	Close-up	Lactation (F)	Lactation (PF)
DM	61	50	55	57
CP	14.1	14.5	16.6	16.8
NE_L, Mcal/kg	1.52	1.52	1.62	1.65
NDF	47.7	41.2	33.5	31.5
Starch	17.1	19.6	24.1	27.3
DCAD, meq/kg	349	-101	236	221

Diamond V

Materials and Methods

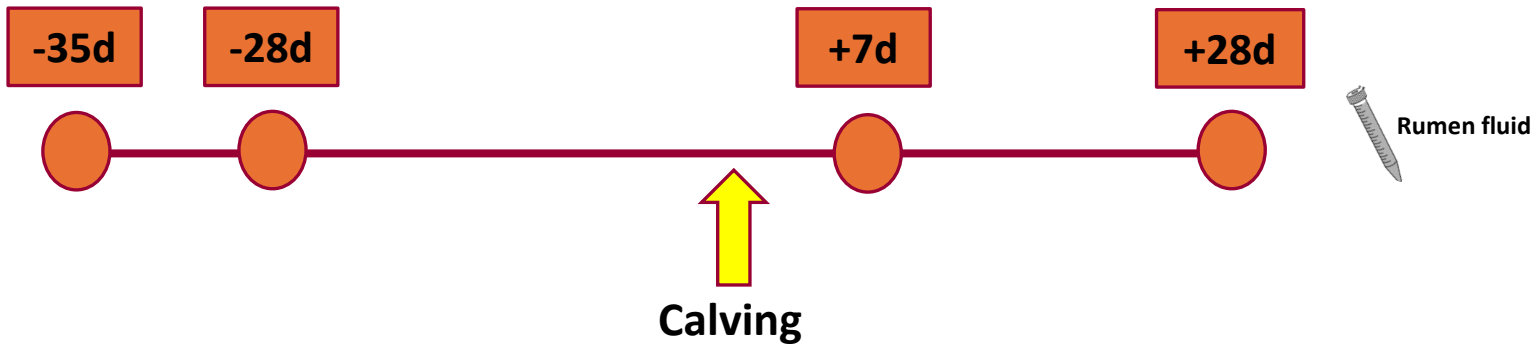
Milked 2x/d (1 am & 12 pm)
- Milk composition weekly

BW – weekly during prepartum and 2x/d during lactation

BCS - weekly

Blood BHB measured every other day until 11 DIM

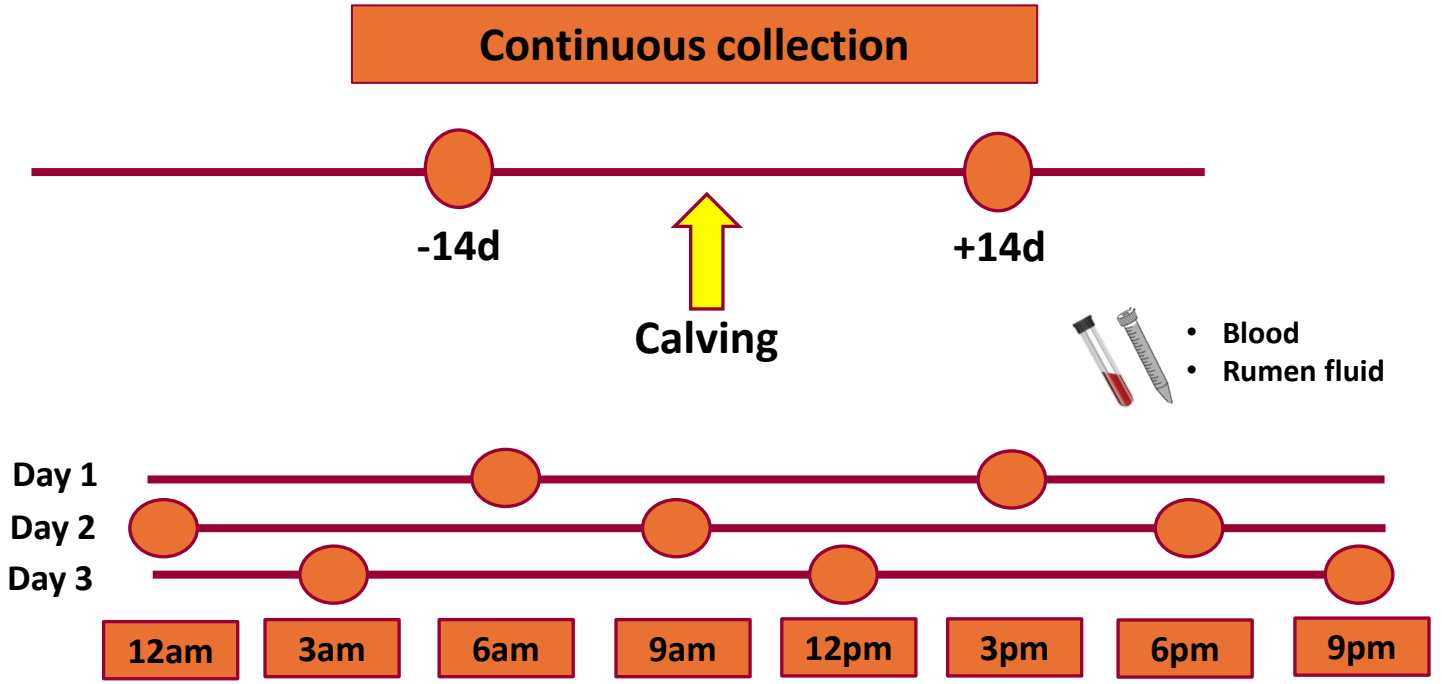
Rumen fluid collection



1x/d (3 – 5 hours after fed);

-35d was used as covariate;

Rumen fluid collection



* Daily rhythms

Statistical analysis

Data were analyzed as repeated measures with the MIXED procedure of SAS version 9.4 (SAS Institute Inc.) using treatment, time (day or week), parity, and 2- and 3-way interactions with treatment as fixed effects and the random effects of cow and block.

Statistical significance declared at $P < 0.05$ and trends at $0.05 < P < 0.10$.

Results

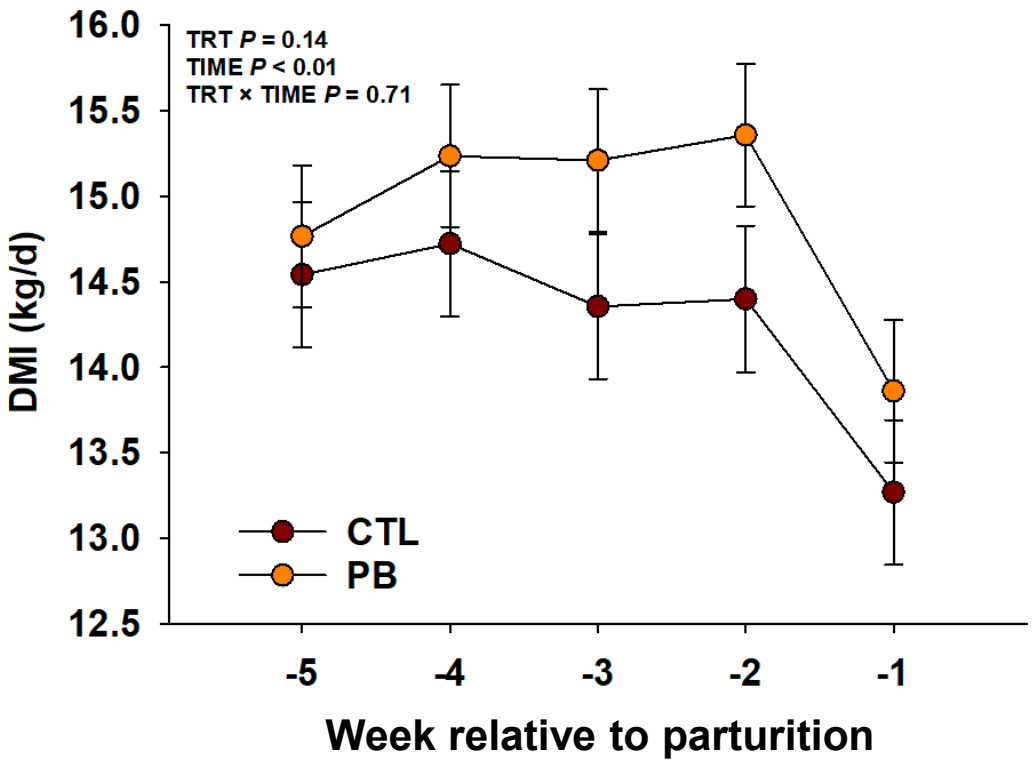
Table 2. Body conformation, DMI, DMI as % BW, and energy balance results of group of cows.

Parameter	TREATMENT		SEM[1]	*P*-value[2]		
	CTL	PB		Trt	Time	Trt × Time
Prepartum						
DMI, kg/d	14.3	14.9	0.36	0.14	<0.01	0.71
DMI, %BW	1.8	1.9	0.04	0.15	<0.01	0.47
BW, kg	799	795	4.53	0.38	<0.01	0.21
BCS	3.85	3.82	0.06	0.71	0.02	0.83
Energy Balance, Mcal/d	5.5	7.6	0.58	<0.01	<0.01	0.28
Energy Balance, %	137.4	148.0	3.84	0.03	<0.01	0.28
Postpartum						
DMI, kg/d	23.4	24.2	0.63	0.09	<0.01	0.10
DMI, %BW	3.3	3.5	0.08	<0.01	<0.01	0.03
Body Weight, kg	712	702	7.29	0.30	<0.01	0.73
BCS	3.29	3.19	0.05	0.17	<0.01	0.88
Energy Balance, Mcal/d	-11.0	-11.3	0.93	0.72	<0.01	0.85
Energy Balance, %	78.3	78.2	1.66	0.95	<0.01	0.74

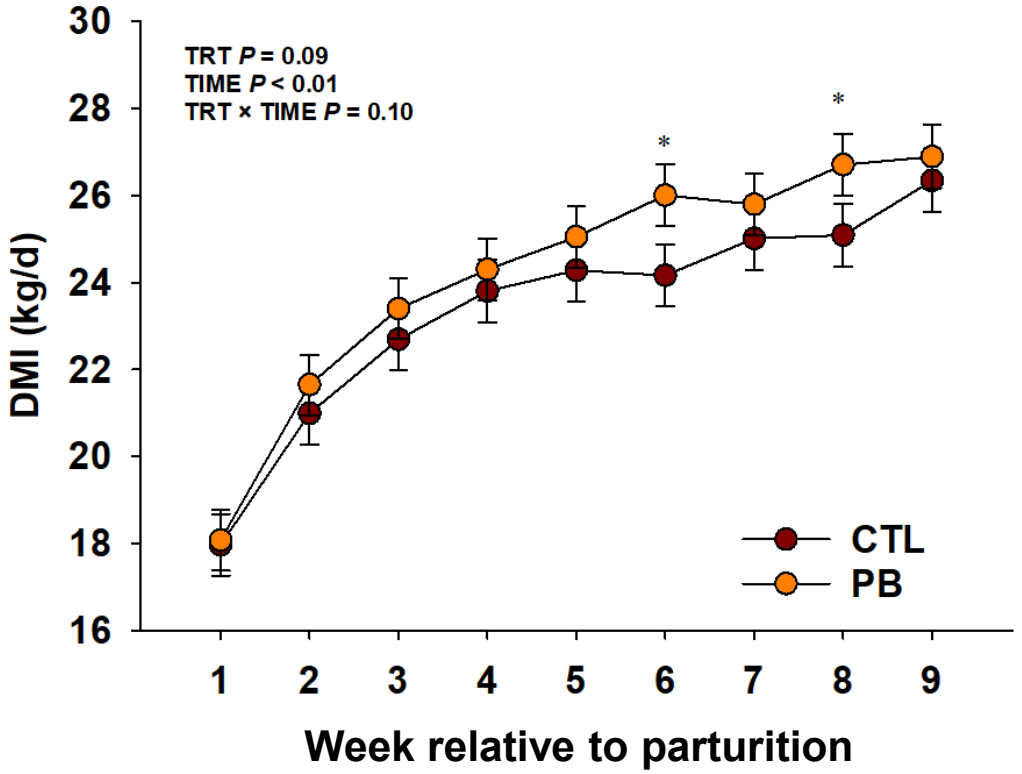
[1]Largest standard error of the mean

Feed Intake

PREPARTUM

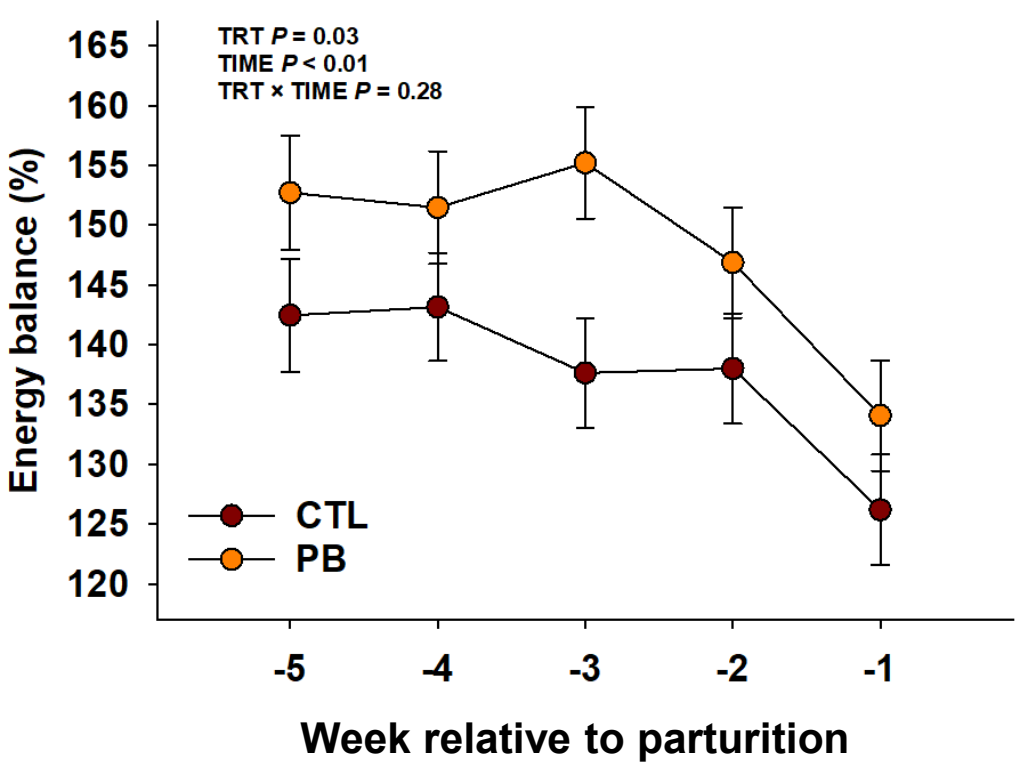


POSTPARTUM



Energy balance

PREPARTUM



POSTPARTUM

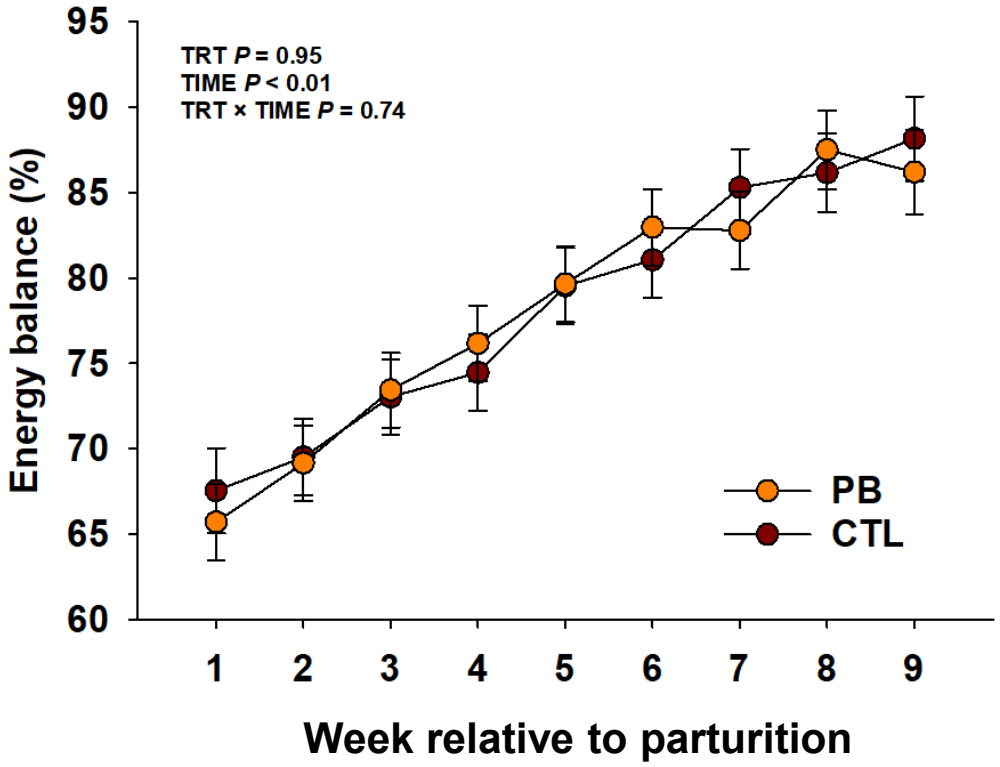
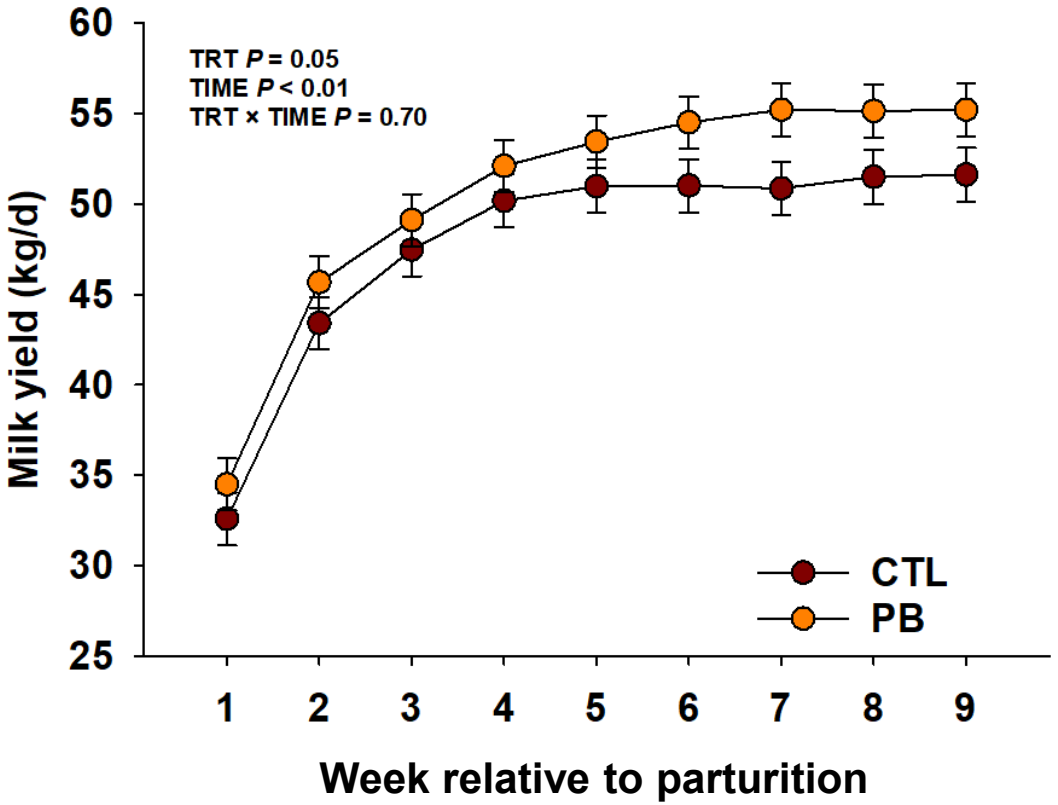


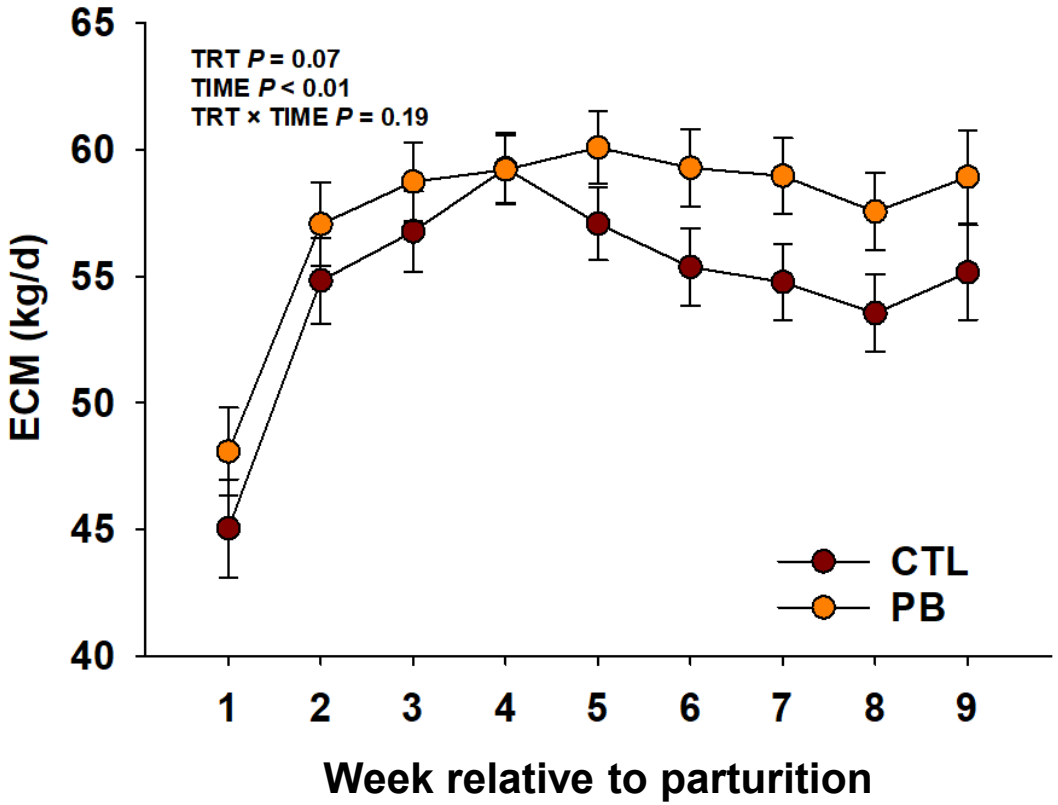
Table 3. Milk production and feed efficiency

Parameter	TREATMENT		SEM[1]	*P-value*		
	CTL	PB		Trt	Time	Trt × Time
Milk Yield, Kg/d	47.7	50.5	1.35	0.05	<0.01	0.70
Milk Fat, %	4.83	4.83	0.13	0.95	<0.01	0.70
Milk Protein, %	3.06	3.05	0.04	0.79	<0.01	0.86
Milk Fat, kg/d	2.27	2.38	0.05	0.16	<0.01	0.68
Milk Protein, kg/d	1.43	1.52	0.05	0.04	<0.01	0.33
MUN, mg/dL	15.56	15.39	0.34	0.67	0.33	0.07
MSCLS, %	0.60	0.39	0.35	0.57	0.03	0.37
ECM, kg/d	54.6	57.5	1.26	0.07	<0.01	0.19
Milk Yield/DMI	2.05	2.08	0.05	0.75	<0.01	0.27
ECM/DMI	2.39	2.41	0.06	0.79	<0.01	0.92

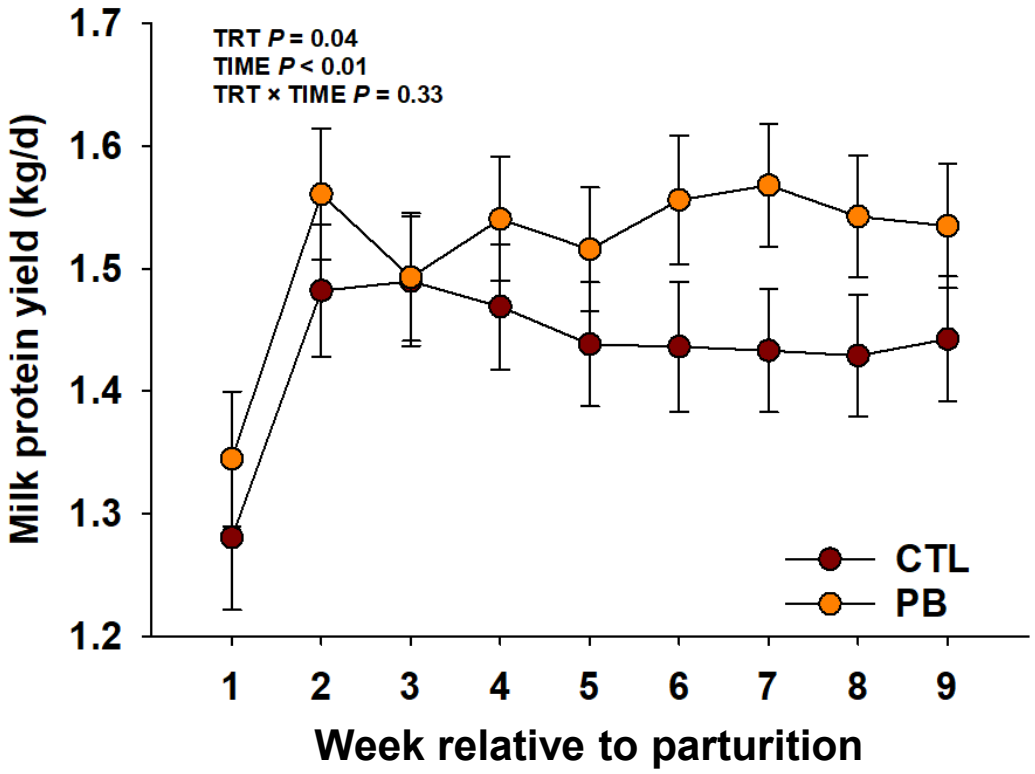
[1]Largest standard error of the mean

Milk performance





Milk composition



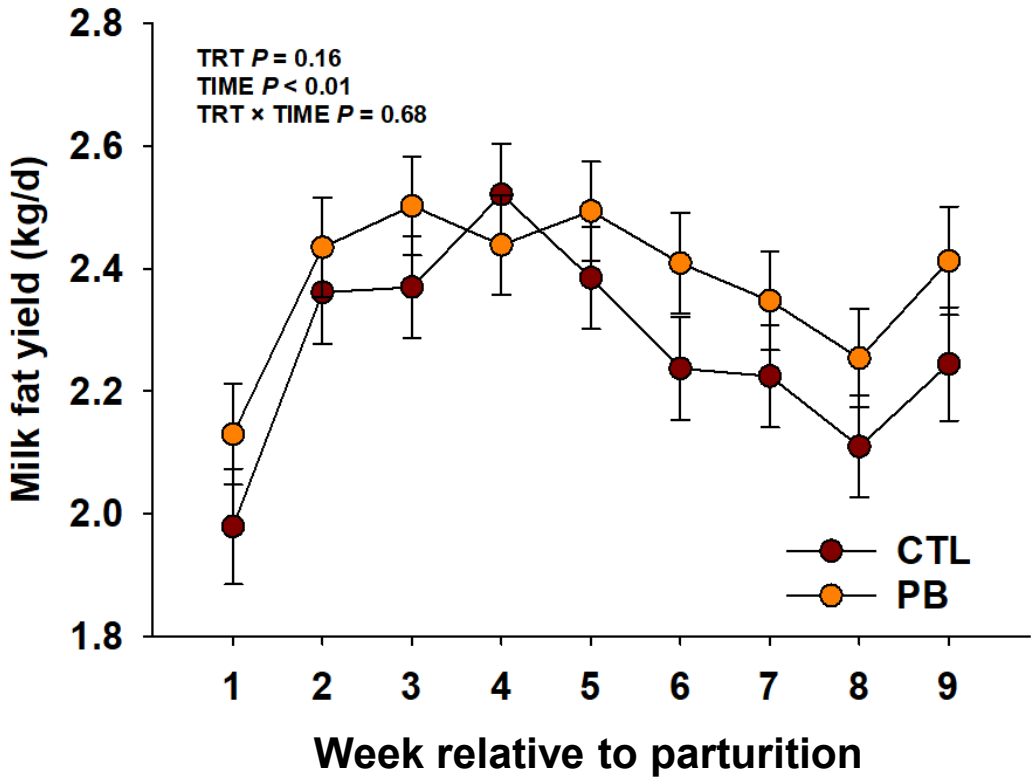
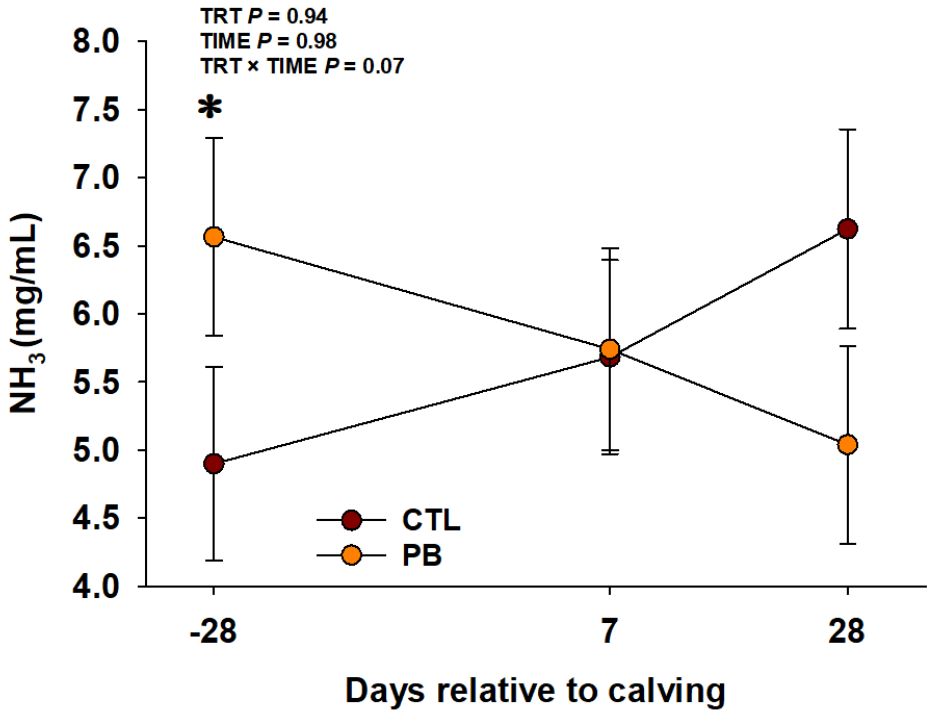


Table 4. Rumen parameters result from daily sampling (-35, -28, 7, and 28 DRC)

Parameter	TREATMENT			*P*-value		
	CTL	PB	SEM[1]	Trt	Time	Trt×Time
Rumen pH	6.68	6.70	0.06	0.73	<0.01	0.72
NH_3, mg/mL	5.74	5.78	0.50	0.94	0.98	0.07
Total VFA, mmol/L	56.6	53.2	3.52	0.42	<0.01	0.50
Acetate, %	63.0	63.1	0.84	0.89	<0.01	0.21
Propionate, %	24.6	24.6	0.61	0.97	<0.01	0.07
Butyrate, %	12.3	12.0	0.62	0.54	<0.01	0.93
Acetate:propionate ratio	2.6	2.6	0.08	0.87	<0.01	0.12

[1]Largest standard error of the mean

Ruminal parameters



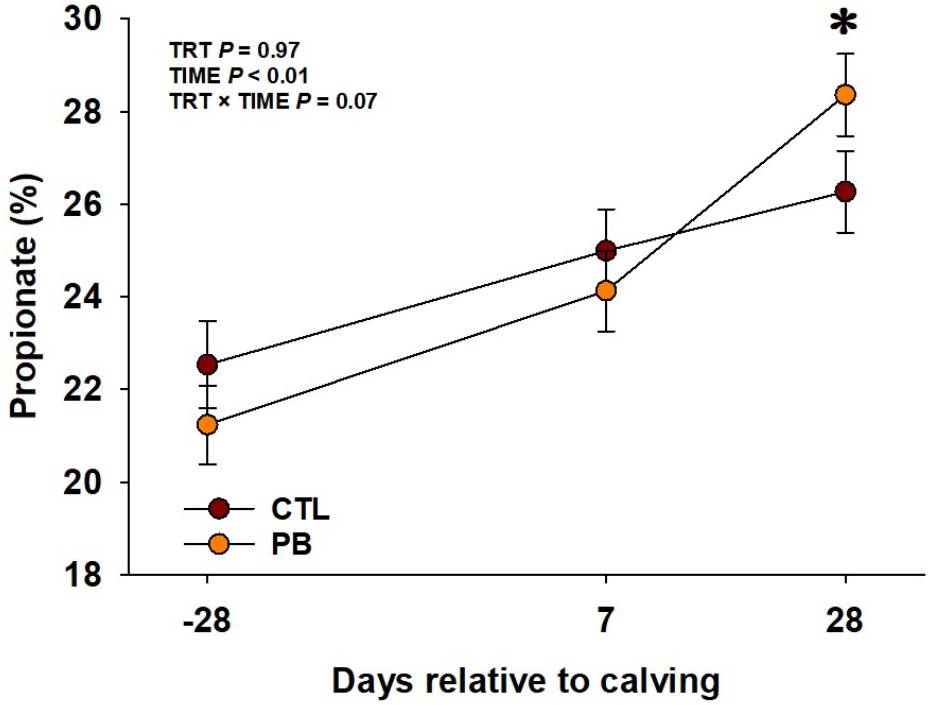


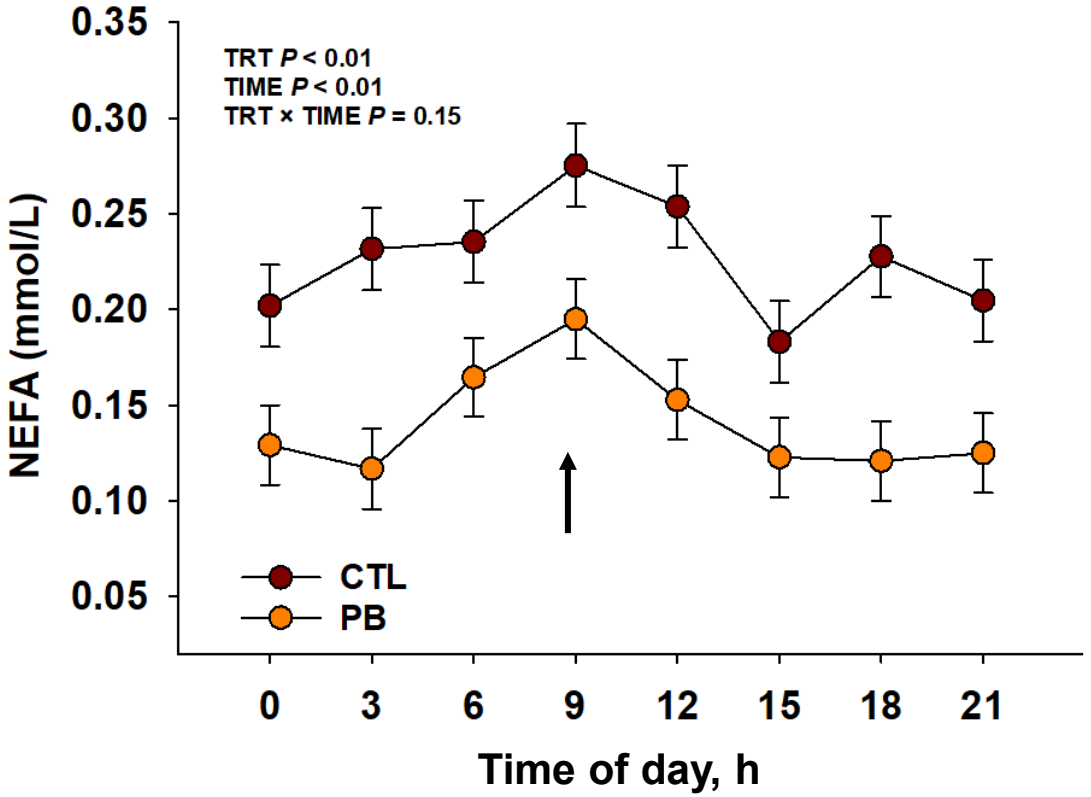
Table 5. Rumen parameters and blood metabolites result from continuous sampling (-14 and 14 DRC)

Parameter	TREATMENT		SEM[1]	*P*-value		
	CTL	PB		Trt	Time	Trt×Time
Prepartum						
Rumen pH	7.00	6.93	0.11	0.28	<0.01	0.33
NH_3, mg/mL	6.38	6.29	0.37	0.86	<0.01	0.99
Glucose, mmol/L	4.54	4.51	0.16	0.72	<0.01	0.46
NEFA, mmol/L	0.23	0.14	0.02	<0.01	<0.01	0.15
BHB, mmol/L	0.58	0.64	0.03	0.09	<0.01	0.99
Urea, mmol/L	4.93	5.47	0.46	0.07	<0.01	0.09
Postpartum						
Rumen pH	6.64	6.57	0.12	0.40	<0.01	0.20
NH_3, mg/mL	6.00	6.49	0.53	0.30	<0.01	0.65
Glucose, mmol/L	3.67	3.92	0.10	0.09	<0.01	0.83
NEFA, mmol/L	0.89	0.71	0.05	0.11	<0.01	0.06
BHB, mmol/L	1.24	1.01	0.32	0.25	<0.01	0.87
Urea, mmol/L	5.09	5.09	0.17	0.99	<0.01	0.14

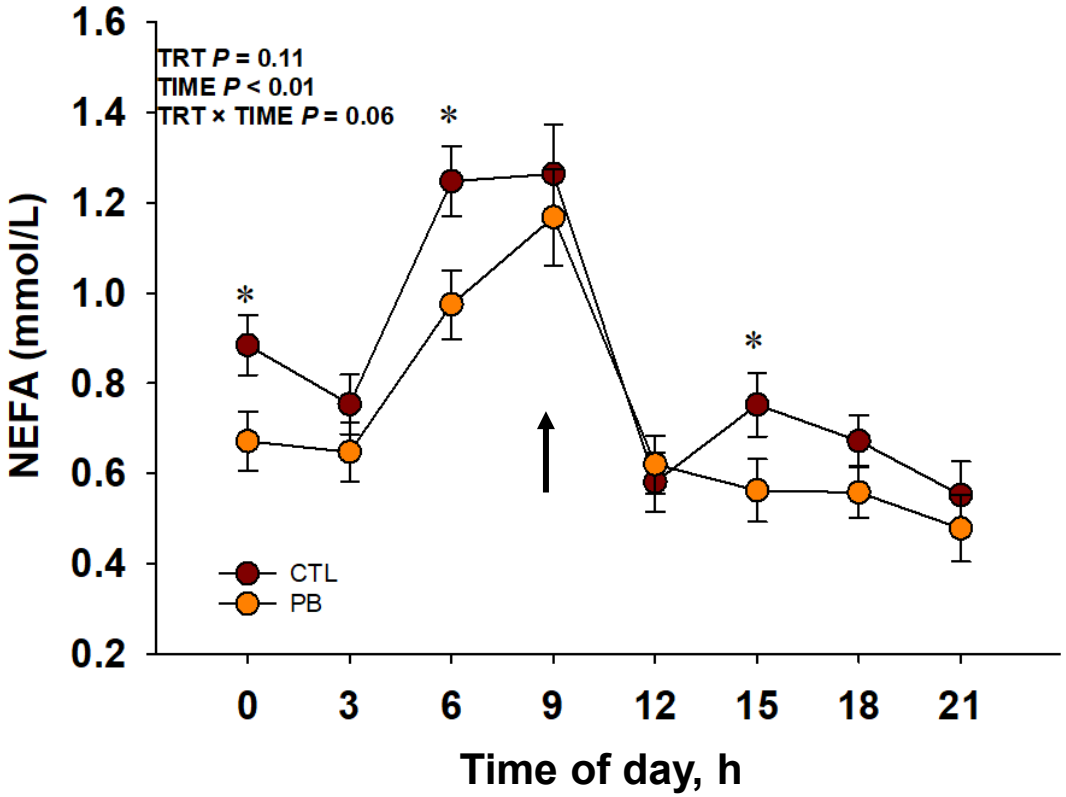
[1]Largest standard error of the mean

Blood biomarkers

PREPARTUM



POSTPARTUM



Conclusion

- Animals supplemented with postbiotics tended to have a better adaptation to lactation, as evidenced by greater milk yield while maintaining adequate energy balance.
- The lower concentration of diurnal NEFA prepartum and postpartum in PB cows suggests a control on lipid mobilization by postbiotic. This could be partially attributed to increased EB prepartum and greater DMI as % BW postpartum.
- A decrease in ruminal NH_3 concentrations in PB cows through the transition period suggests a potential improvement in N efficiency.
- However, further analysis is needed to understand whether there are effects on the rumen fermentation profile.

Acknowledgment

Diamond V
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Thank you!

Osorio Lab

Diamond V

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