HEAT STRESS IN LATE GESTATION: EFFECTS ON DAM PERFORMANCE

Selko DairyNutriVision 2024

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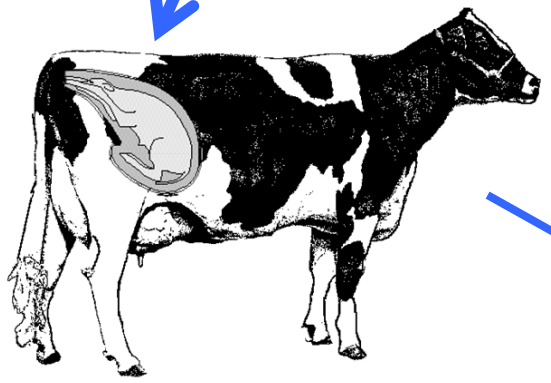
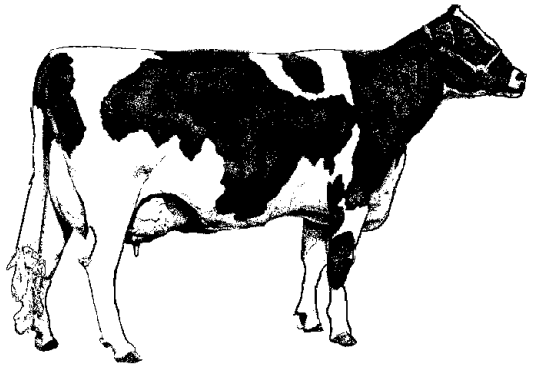
Late gestation



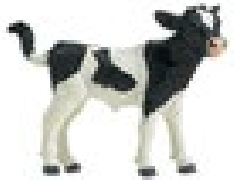
Milk yield?
Metabolism?
Immune function?
Placental Function?



DAM

vs.

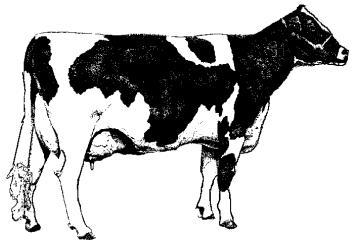
DAUGHTER



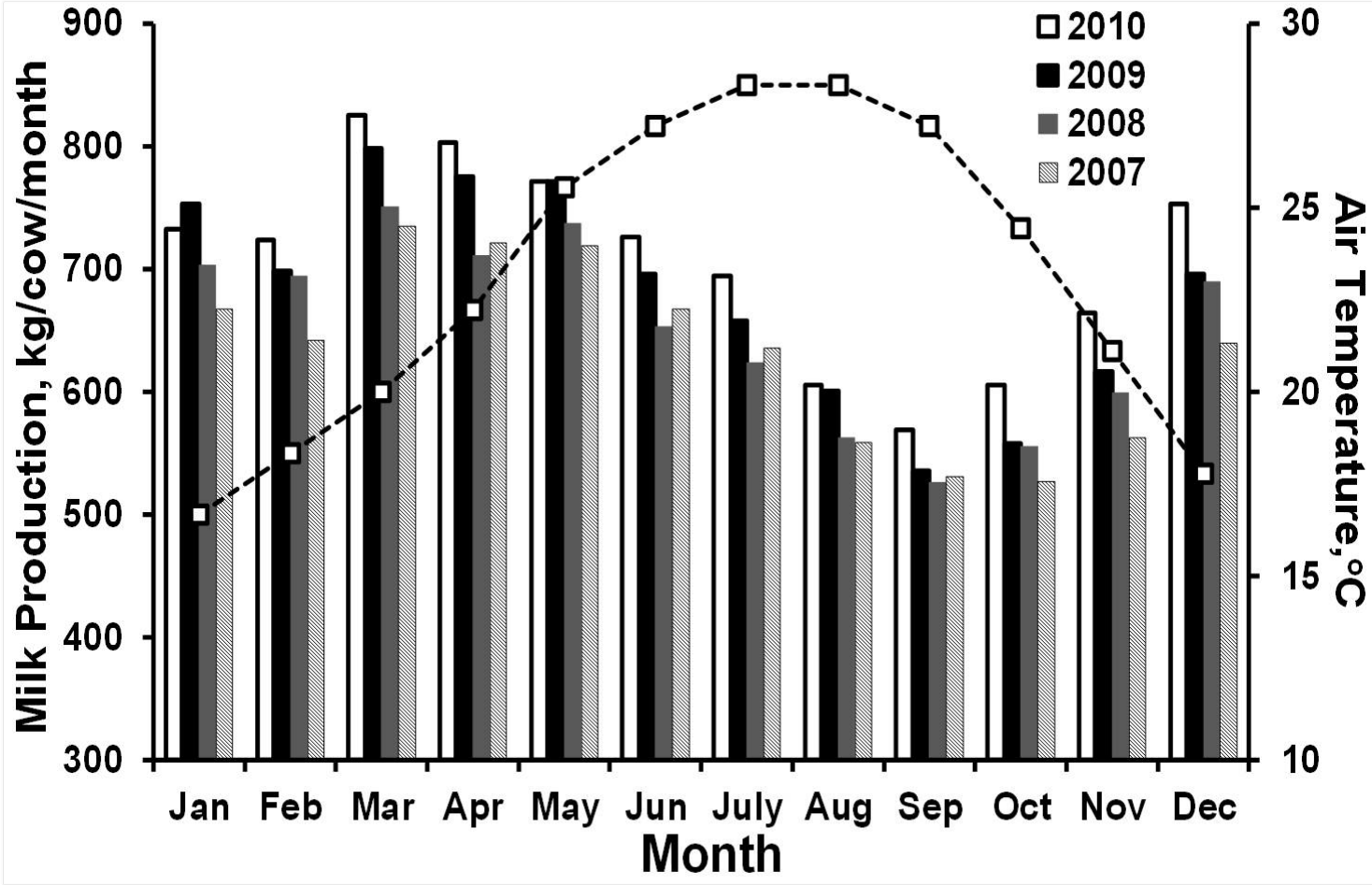
Calf health?
Calf growth?

Heifer growth?
Reproduction?

Cow performance?
Thermoregulation?
Survival?



HEAT STRESS EFFECTS ON YIELD PERSIST

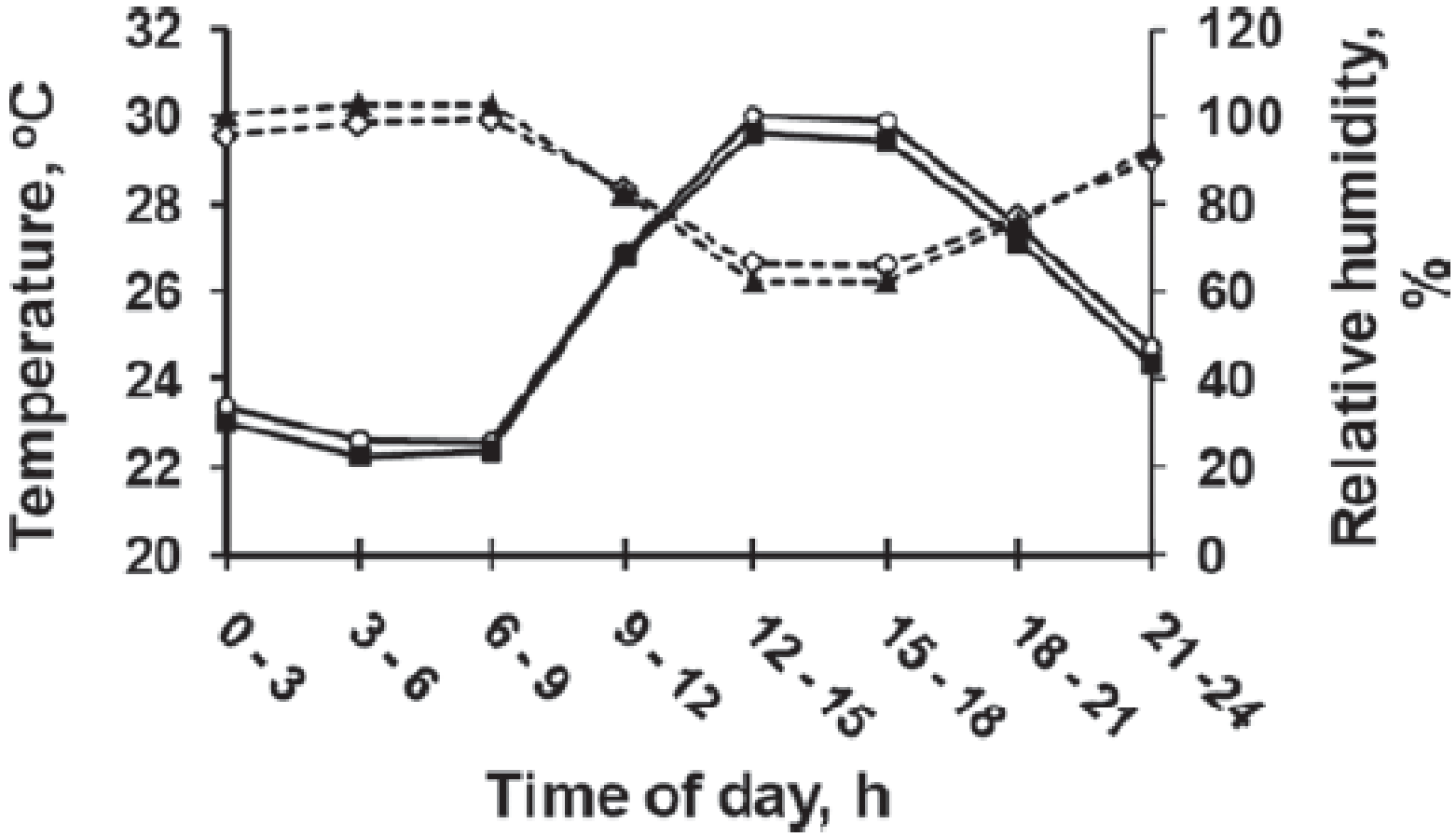


Tao & Dahl, *J. Dairy Sci.* 96:4079-4093

Gainesville, Florida, USA

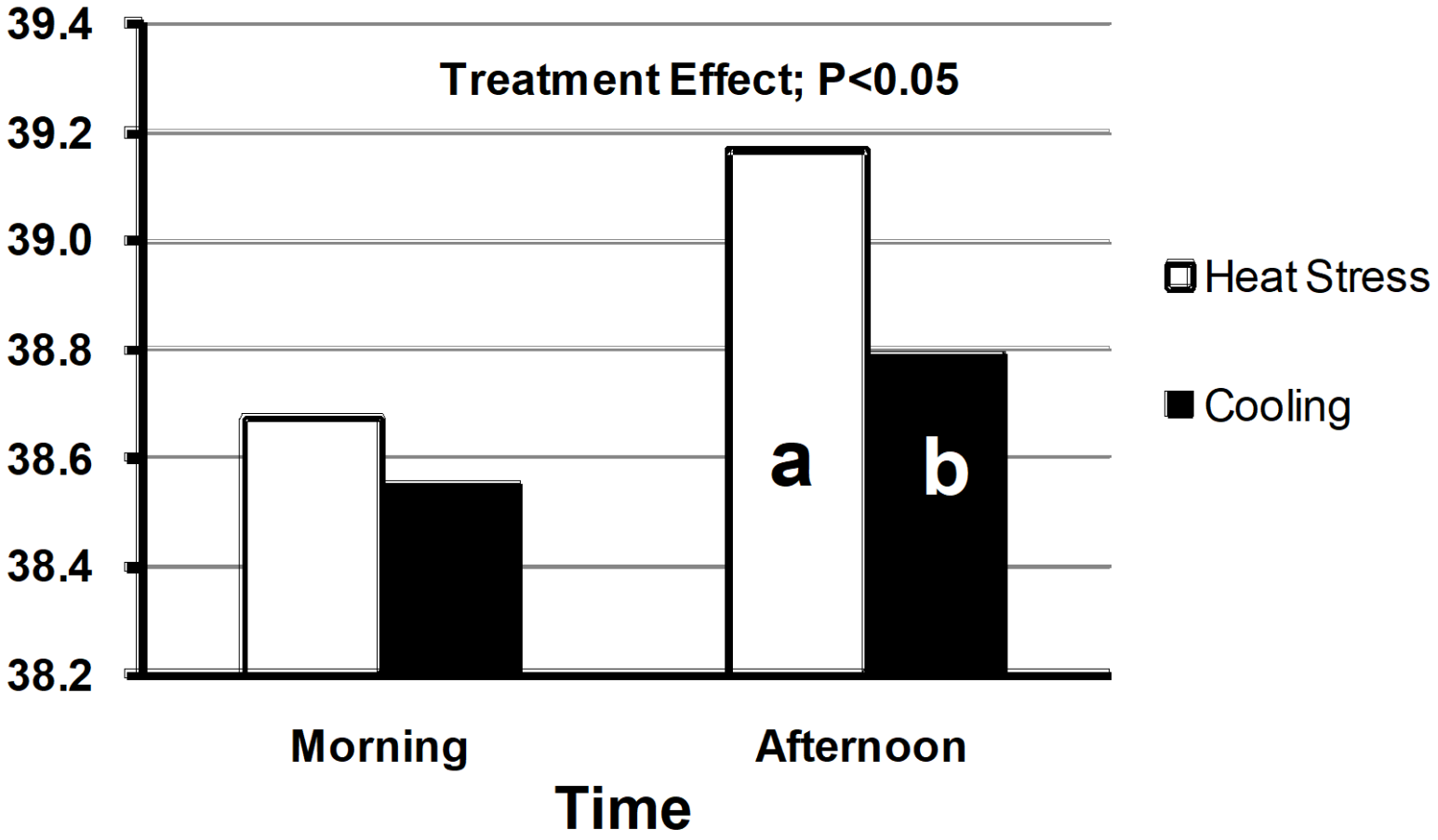
- Sand bedded free stalls
- Fans over stalls
- Soakers over feedline
- Fans on at 70° F (21.1°C)
- Soakers on 1 min every 5 min at 72° F

STUDY DESIGN: HEAT LOAD ON DRY COWS



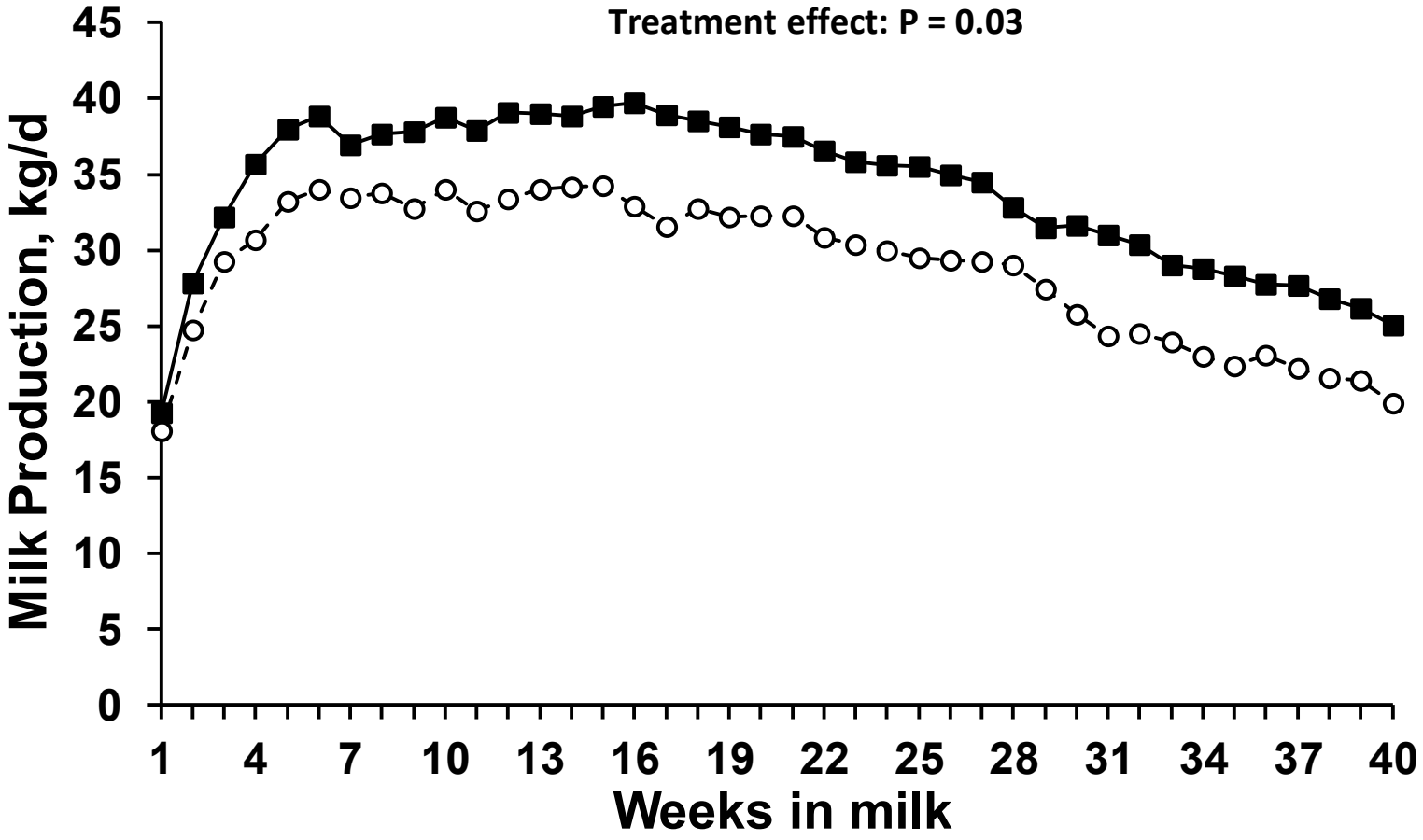
Do Amaral et al., *J. Dairy Sci.* 94:86–96

Heat Stress Increases Mean Rectal Temperature



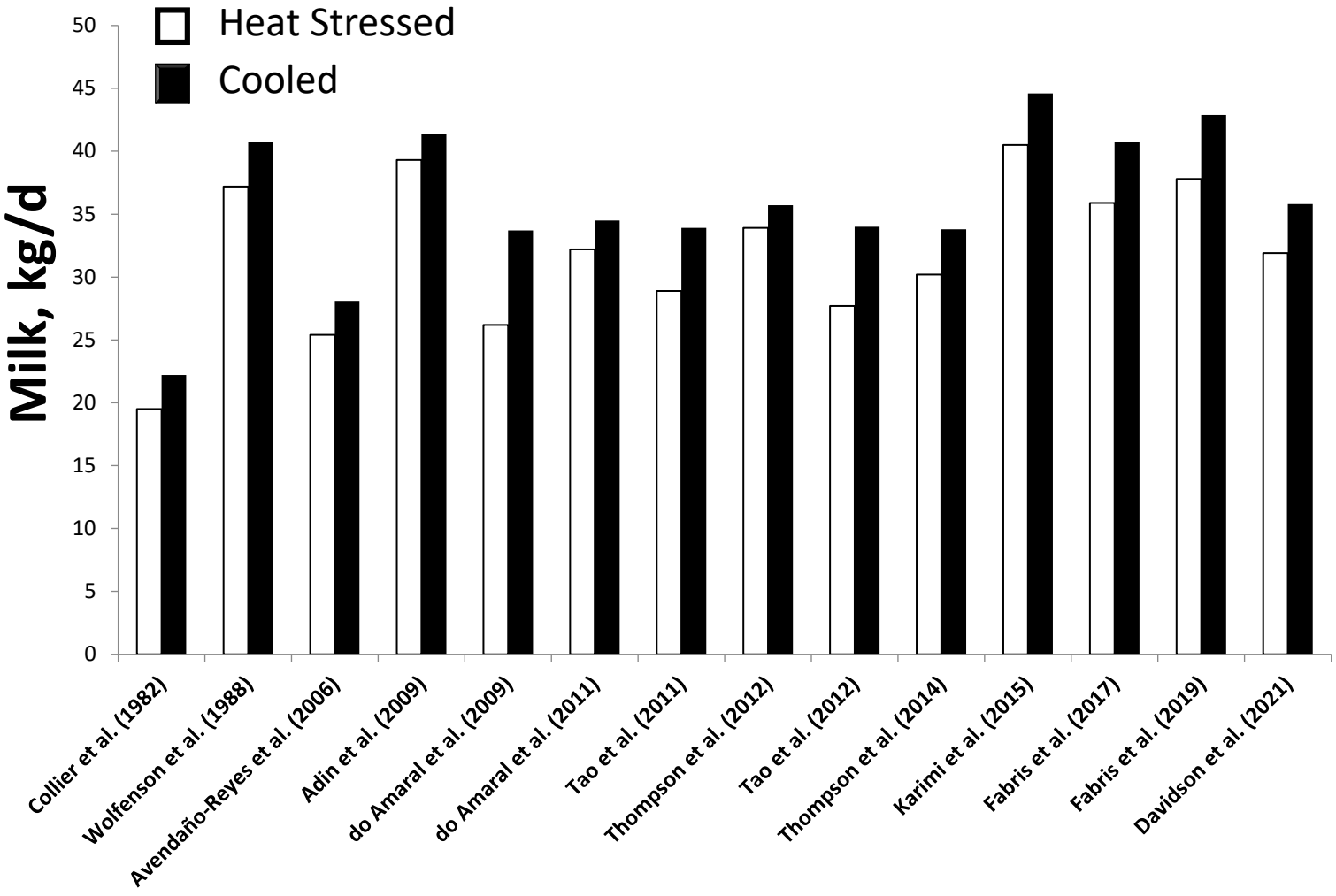
Do Amaral et al., *J. Dairy Sci.* 94:86–96

COOLING DRY COWS INCREASES MILK

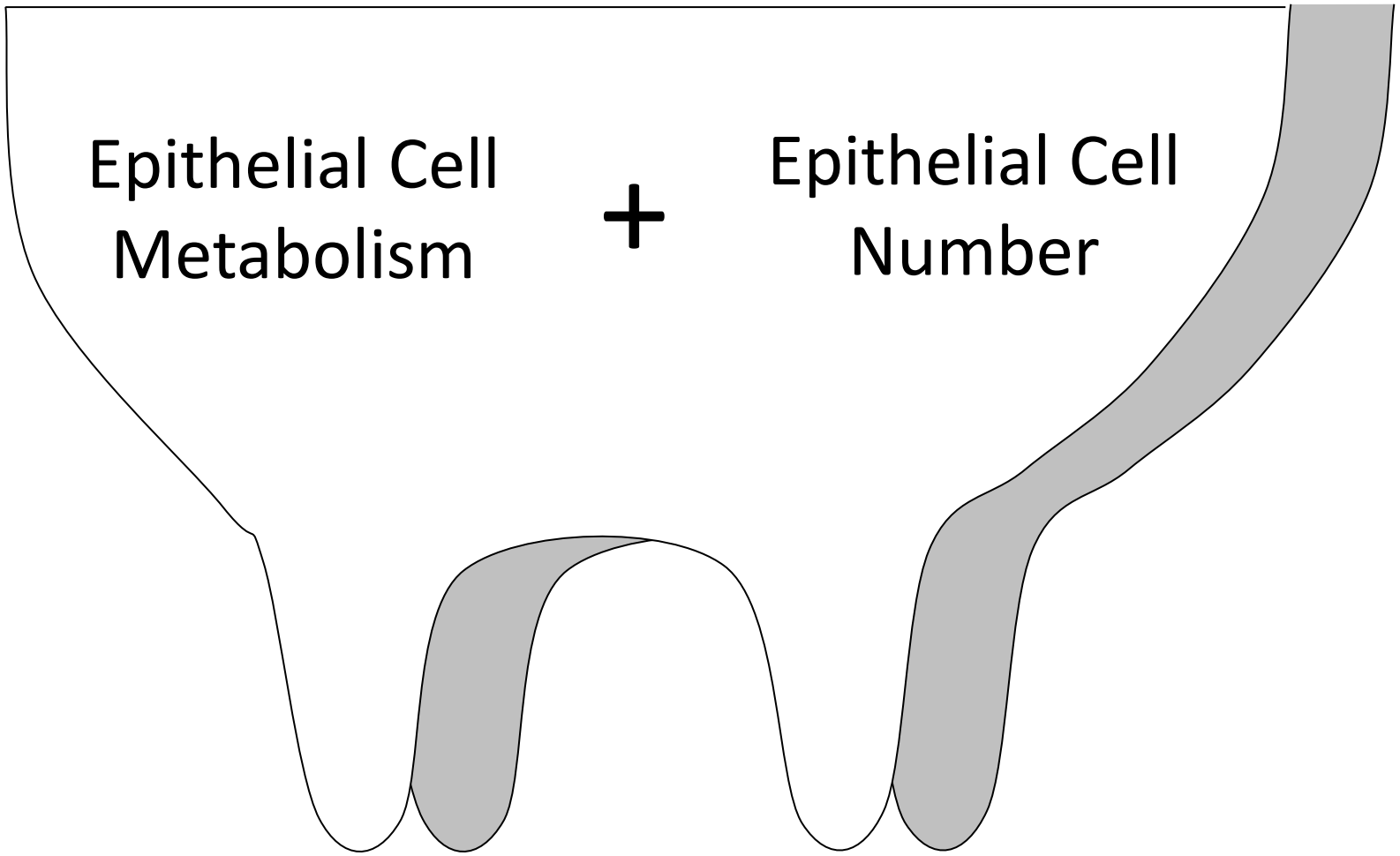


Tao et al., *J. Dairy Sci.* 94:5976–5986

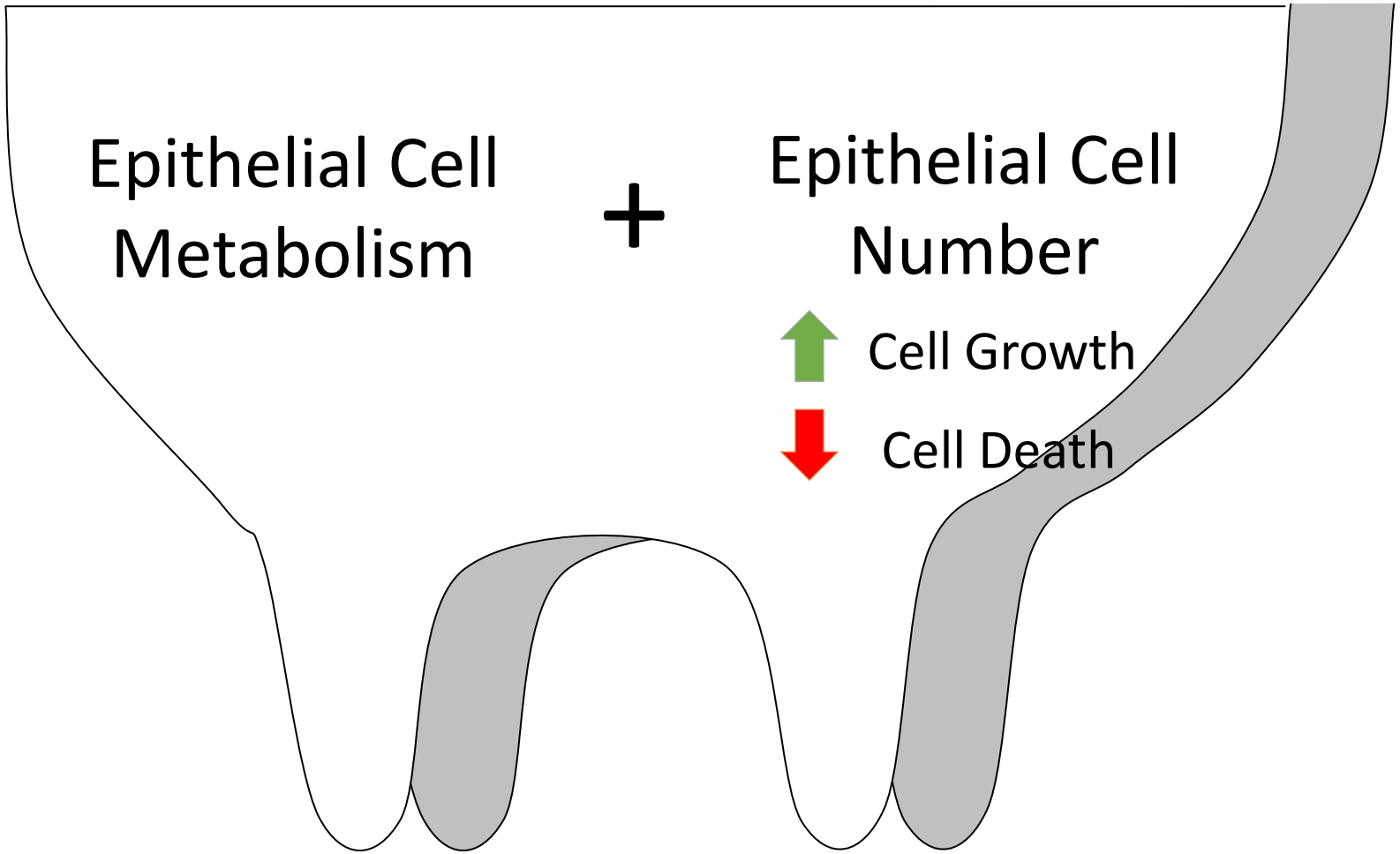
COOLING DRY COWS INCREASES MILK



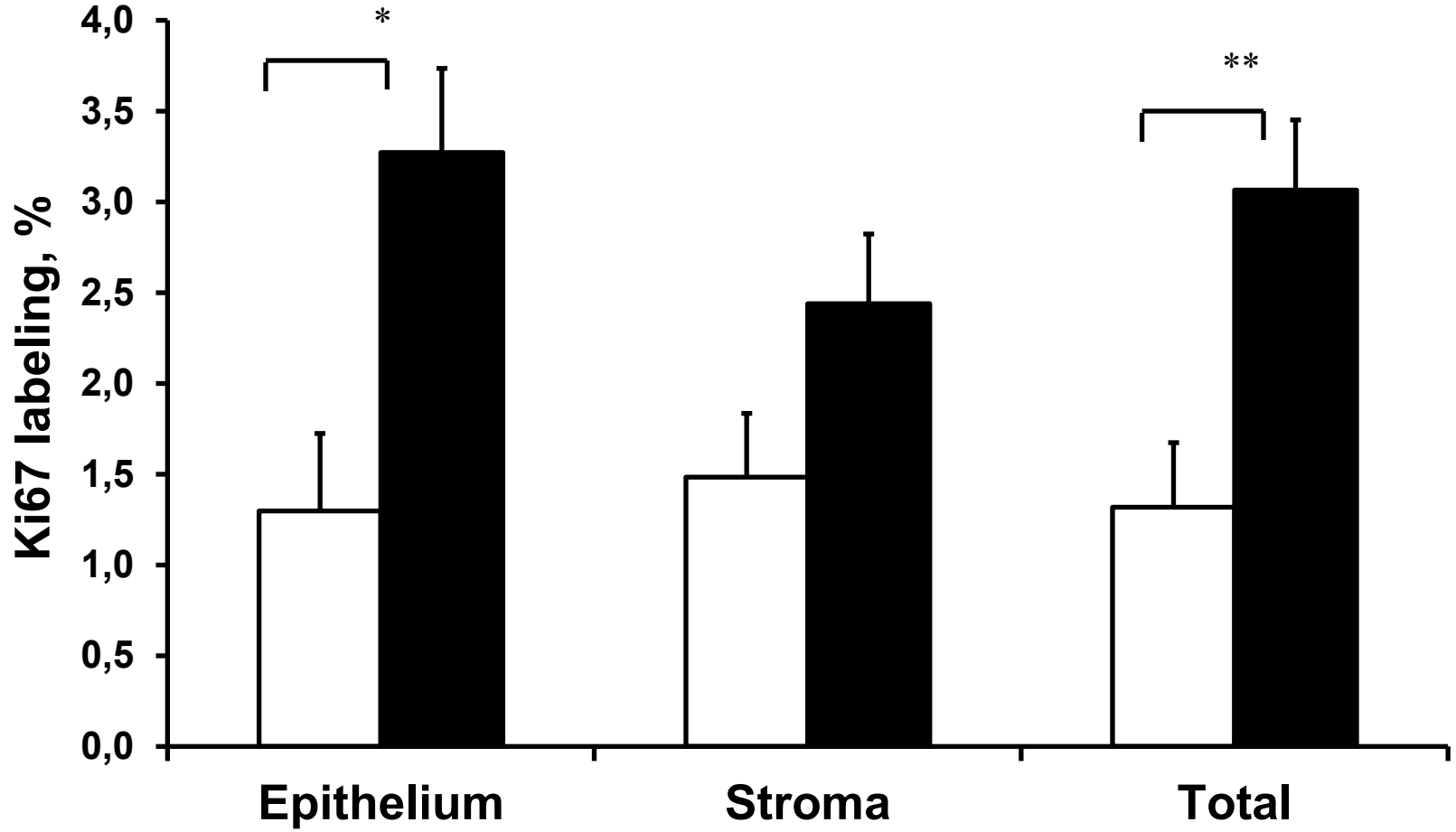
Milk Production



Milk Production

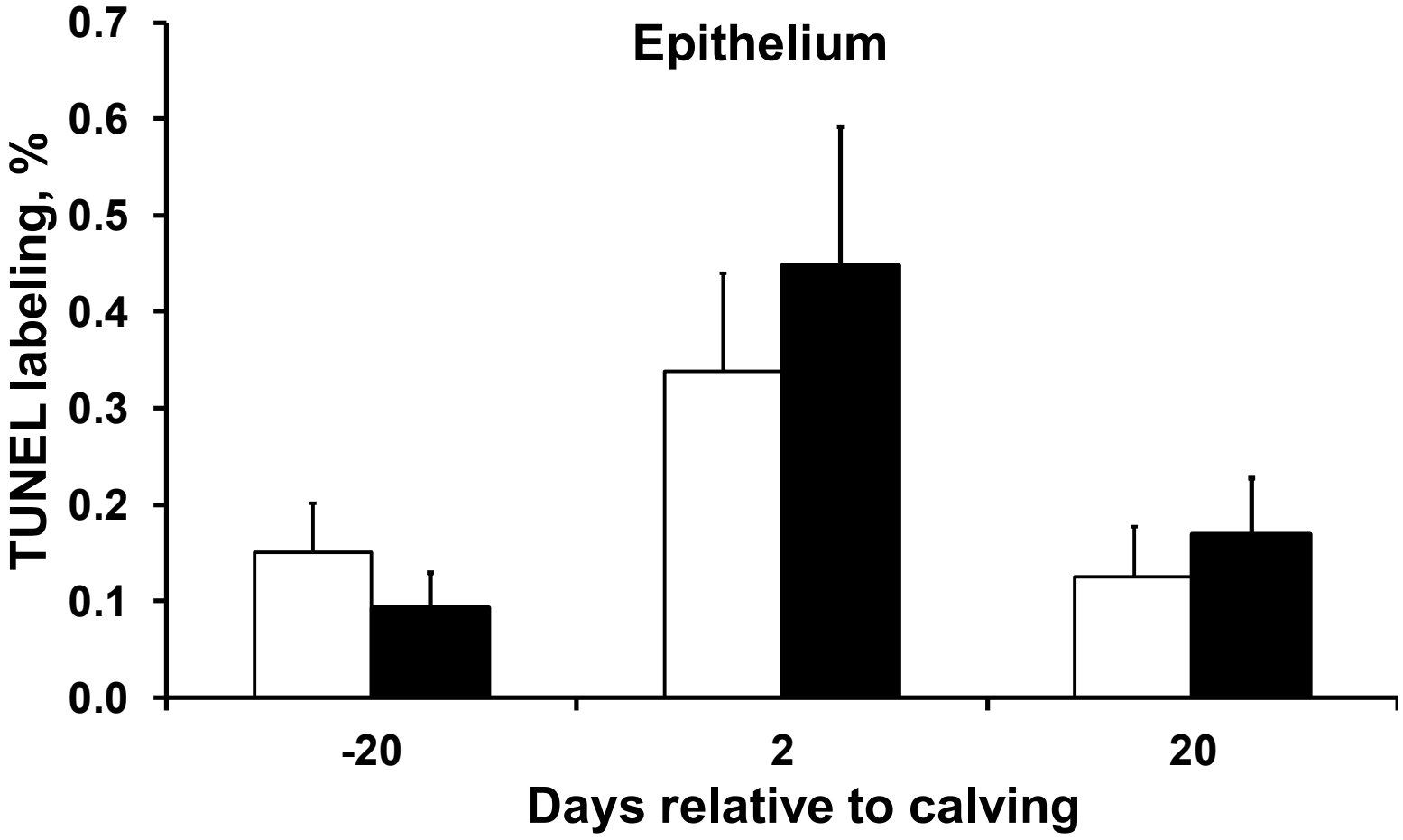


COOLING INCREASED PROLIFERATION OF MAMMARY CELLS PREPARTUM (D-20)



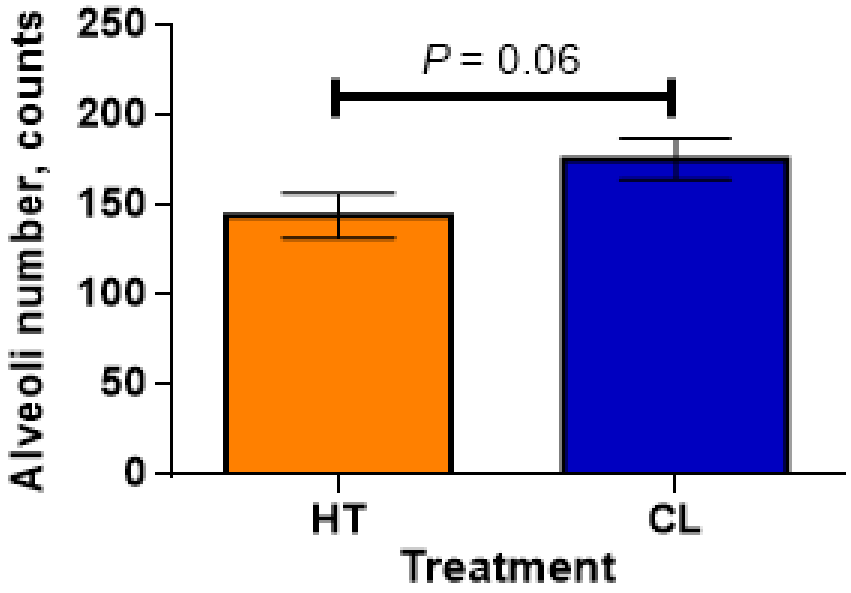
Tao et al., *J. Dairy Sci.* 94:5976–5986

HEAT STRESS DURING DRY PERIOD – NO EFFECT ON MEC APOPTOSIS

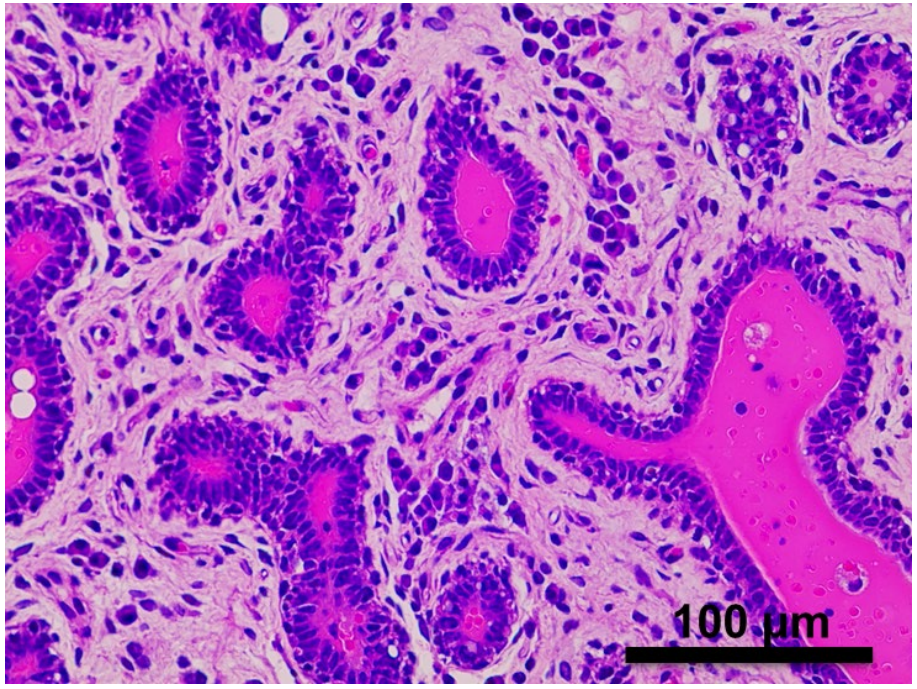


Tao et al., *J. Dairy Sci.* 94:5976–5986

HEAT STRESS DECREASES ALVEOLI NUMBER



H&E Stain



Dry in COOL Months Improves Performance

Table 1. Milk production and occurrence of mastitis, digestive and respiratory problems, retained fetal membranes, and metritis in cows dried during HOT months (Jun, Jul, Aug) or COOL months (Dec, Jan, Feb) in the first 80 DIM of the subsequent lactation

	Dry during HOT months (Jun, Jul, Aug), n = 1,569				Dry during COOL months (Dec, Jan, Feb), n = 1,044				
Item	**Value**	**Disease[1]**	**n**	**%**	**Value**	**Disease[1]**	**n**	**%**	***P*-value**
Milk production (kg)	10,351 ± 59.8				10,902 ± 73.3				0.01
Mastitis		0	1,286	82.0		0	950	91.0	0.01
		1	283	18.0		1	94	9.0	
Digestive		0	1,516	96.6		0	973	93.2	0.01
		1	53	3.4		1	71	6.8	
Respiratory		0	1,346	85.8		0	942	90.2	0.01
		1	223	14.2		1	102	9.8	
Retained fetal membranes		0	1,500	95.6		0	1,013	97.0	0.06
		1	69	4.4		1	31	3.0	
Metritis		0	1,500	95.6		0	1,007	96.4	0.35
		1	67	4.2		1	38	3.5	

[1]Disease: 0 = cows without the disease; 1 = cows with the disease.

Thompson & Dahl, *Prof. Anim. Sci.* 28:628-631

Dry in COOL Months Improves Reproductive Performance

Table 3. Milk production and reproductive performance of cows dried during HOT months (Jun, Jul, Aug) or COOL months (Dec, Jan, Feb) in the first 150 DIM of the subsequent lactation on a commercial farm in Florida

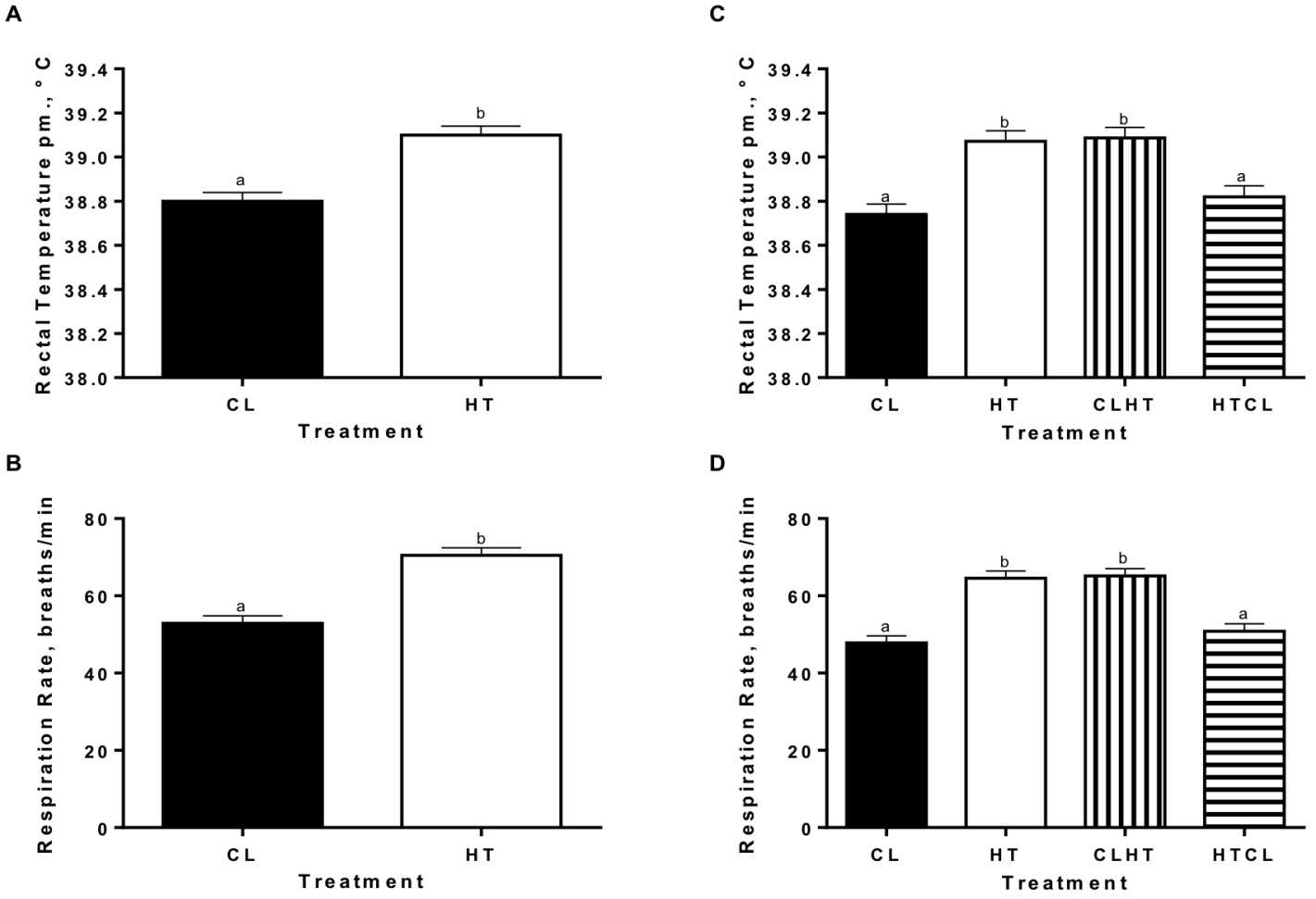
Item	Dry during HOT months (Jun, Jul, Aug)	Dry during COOL months (Dec, Jan, Feb)	*P*-value
Milk production (kg)	10,547 ± 67.0	11,005 ± 83.38	0.01
Number of breedings (n)	1,048	676	0.03
Mean (no.)	1.59 ± 0.02	1.51 ± 0.03	
DIM to breeding (n)	1,047	676	0.01
Mean (d)	97.0 ± 0.74	91.8 ± 0.92	
DIM to pregnancy (n)	1,051	679	0.01
Mean (d)	131.1 ± 0.85	125.9 ± 1.06	

Thompson & Dahl, *Prof. Anim. Sci.* 28:628-631

LATE GESTATION COOLING

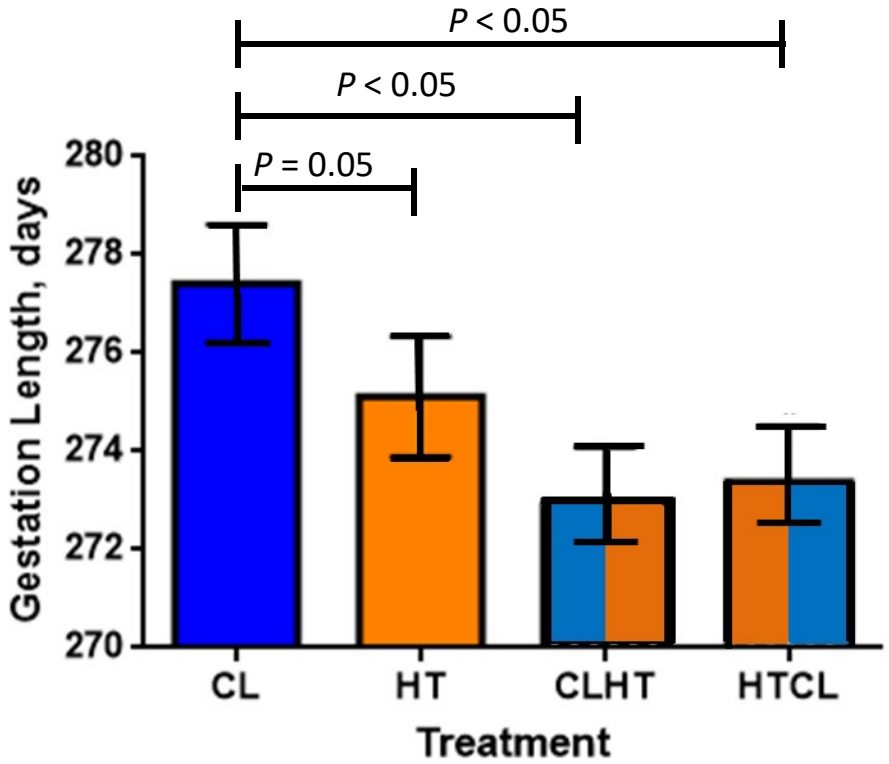
- Do I have to cool cows the entire dry period?
- Do heifers need to be cooled pre-partum?
- Nutritional interventions to limit HT effects?

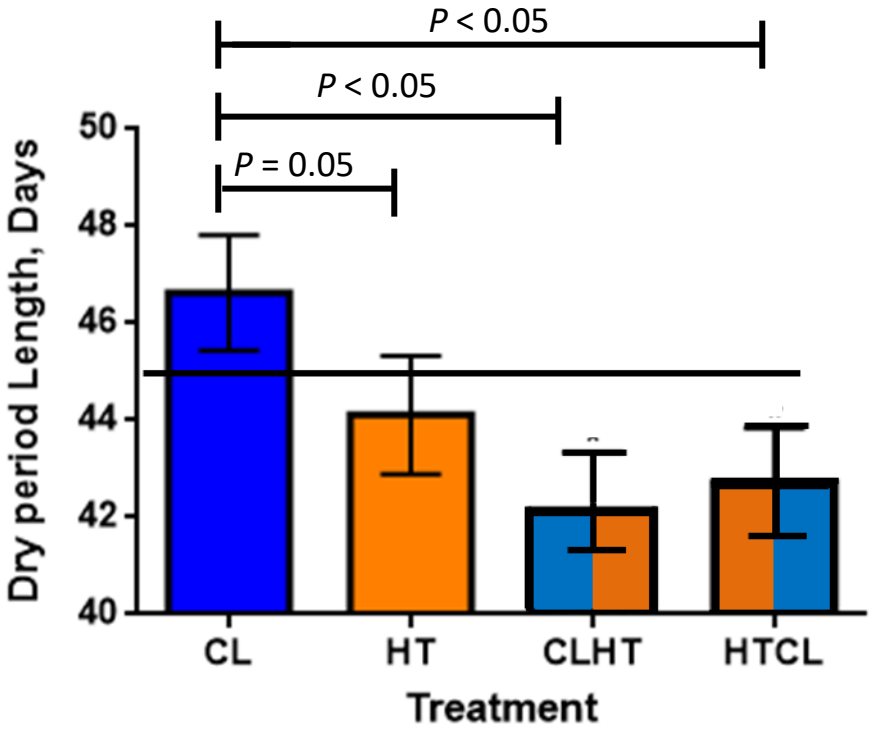
HEAT STRESS INCREASES RECTAL TEMPERATURE AND RESPIRATION



Fabris et al. , *J. Dairy Sci*. 102:5647-5656.

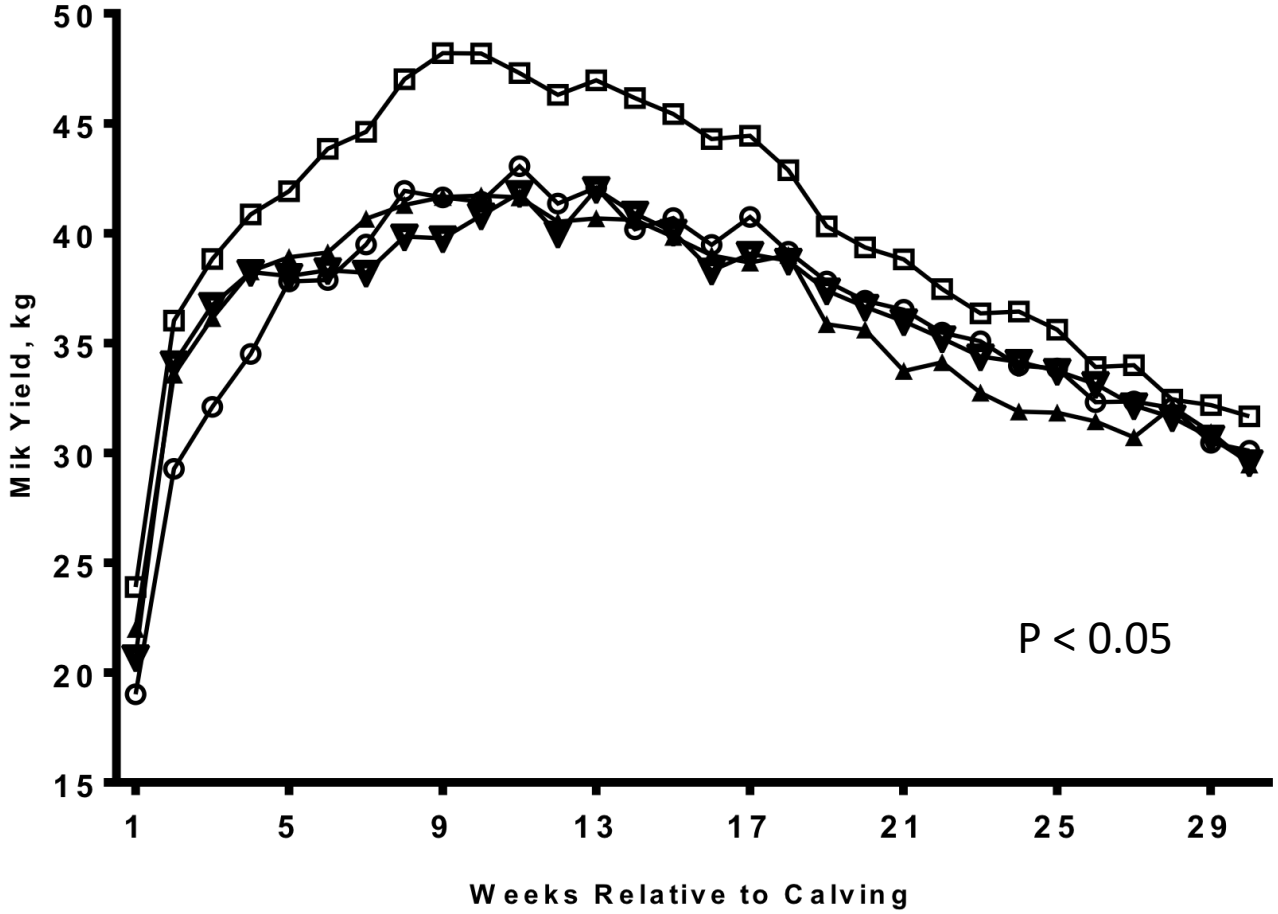
HEAT STRESS DECREASES GESTATION LENGTH AND DRY PERIOD LENGTH AT ANY TIME





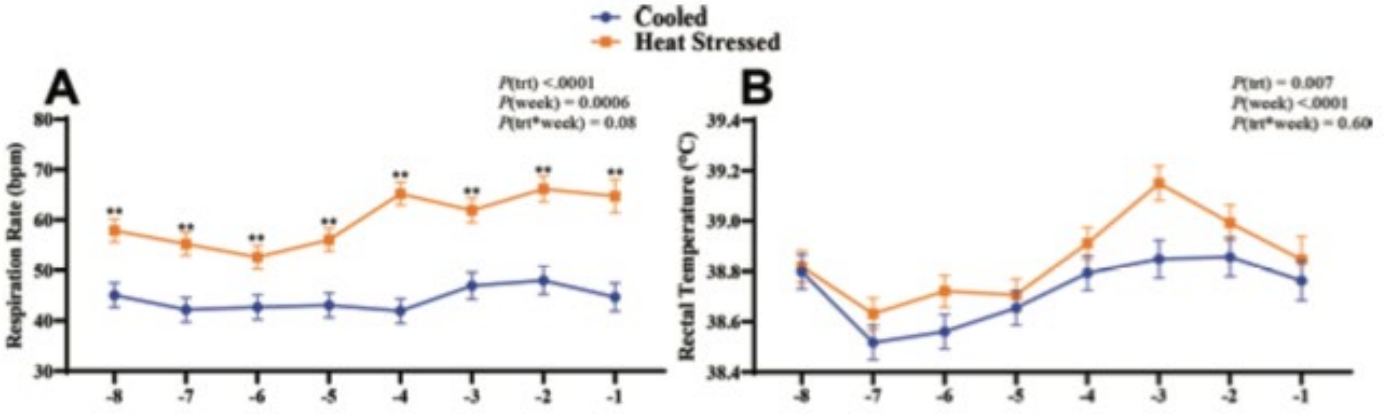
Fabris et al. , *J. Dairy Sci*. 102:5647-5656.

HEAT STRESS IMPOSED AT ANY TIME IN THE DRY PERIOD REDUCES MILK



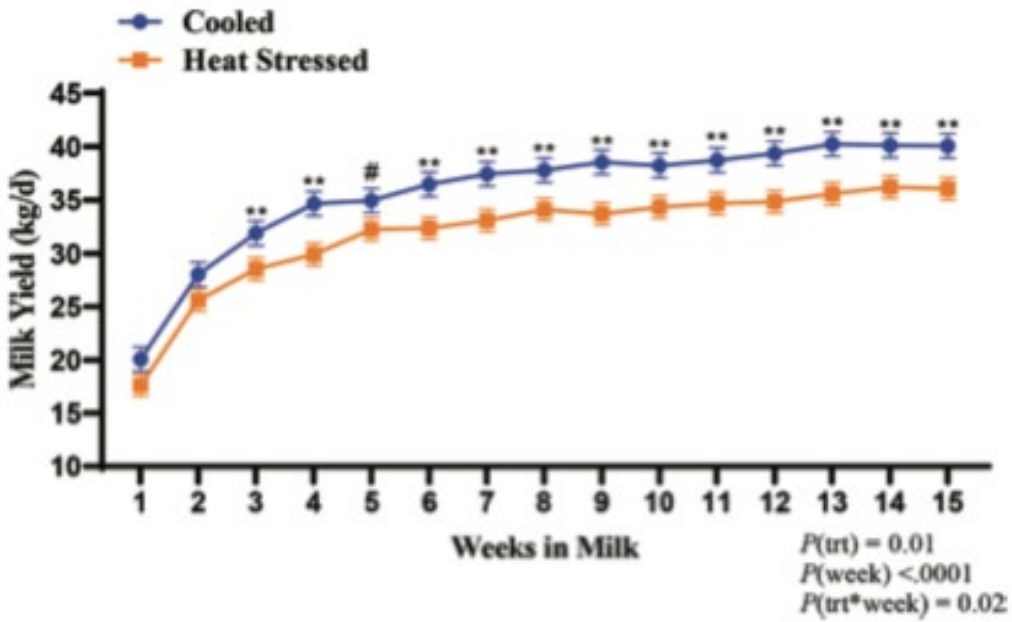
Fabris et al. , *J. Dairy Sci*. 102:5647-5656.

EFFECTS ON FIRST CALF HEIFERS: COOLING DECREASES RR AND RT



Davidson et al, *J. Dairy Sci.* 104:2357-2368

EFFECTS ON FIRST CALF HEIFERS: COOLING INCREASES YIELD



Davidson et al, *J. Dairy Sci.* 104:2357-2368

EFFECTS OF BETAINE SUPPLEMENTATION AND HT: FAR OFF THROUGH 56 DIM

	Treatment			*P*-value		
Parameter	BET	CON	SEM	Treatment	Time	Treatment × time
BW, kg	729	720	26	0.80	<0.01	0.84
BCS	3.44	3.44	0.04	0.91	<0.01	0.32
DMI, prepartum, kg/d	13.6	13.3	0.53	0.64	<0.01	0.93
DMI, postpartum, kg/d	22.8	21.8	1.03	0.51	<0.01	0.14
Glucose, mg/dL	62.6	63.0	2.4	0.91	<0.01	0.19
NEFA, μEq/L	300	236	37	0.30	<0.01	0.03
BHB, mg/L	10.3	9.1	0.5	0.12	0.01	0.08
Milk yield, kg/d	45.1	41.9	1.04	0.04	<0.01	0.91
3.5% FCM, kg/d	53.4	47.3	1.92	0.02	0.47	0.29
ECM, kg/d	50.5	45.2	1.57	0.02	0.37	0.30
FE (FCM/DMI)	2.44	2.27	0.11	0.19	<0.01	0.60
FE (ECM/DMI)	2.31	2.15	0.10	0.19	<0.01	0.61
EB,[1] Mcal	−7.03	−4.22	1.11	0.09	<0.01	0.22
Milk composition						
Fat, %	4.78	4.34	0.19	0.05	<0.01	0.29
Fat, kg/d	2.10	1.77	0.10	0.01	0.88	0.38
Protein, %	2.76	2.77	0.03	0.84	<0.01	0.78
Protein, kg/d	1.21	1.14	0.03	0.05	0.02	0.87
Lactose, %	4.60	4.71	0.04	0.06	<0.01	0.58
Lactose, kg/d	2.09	1.96	0.08	0.27	<0.01	0.67
SNF, %	8.31	8.40	0.10	0.51	<0.01	0.89
SNF, kg/d	3.72	3.46	0.14	0.20	<0.01	0.47
MUN, mg/dL	9.17	9.05	0.54	0.88	<0.01	0.60
SCS	2.7	1.8	0.51	0.16	<0.01	0.64

[1]Energy balance during early lactation.

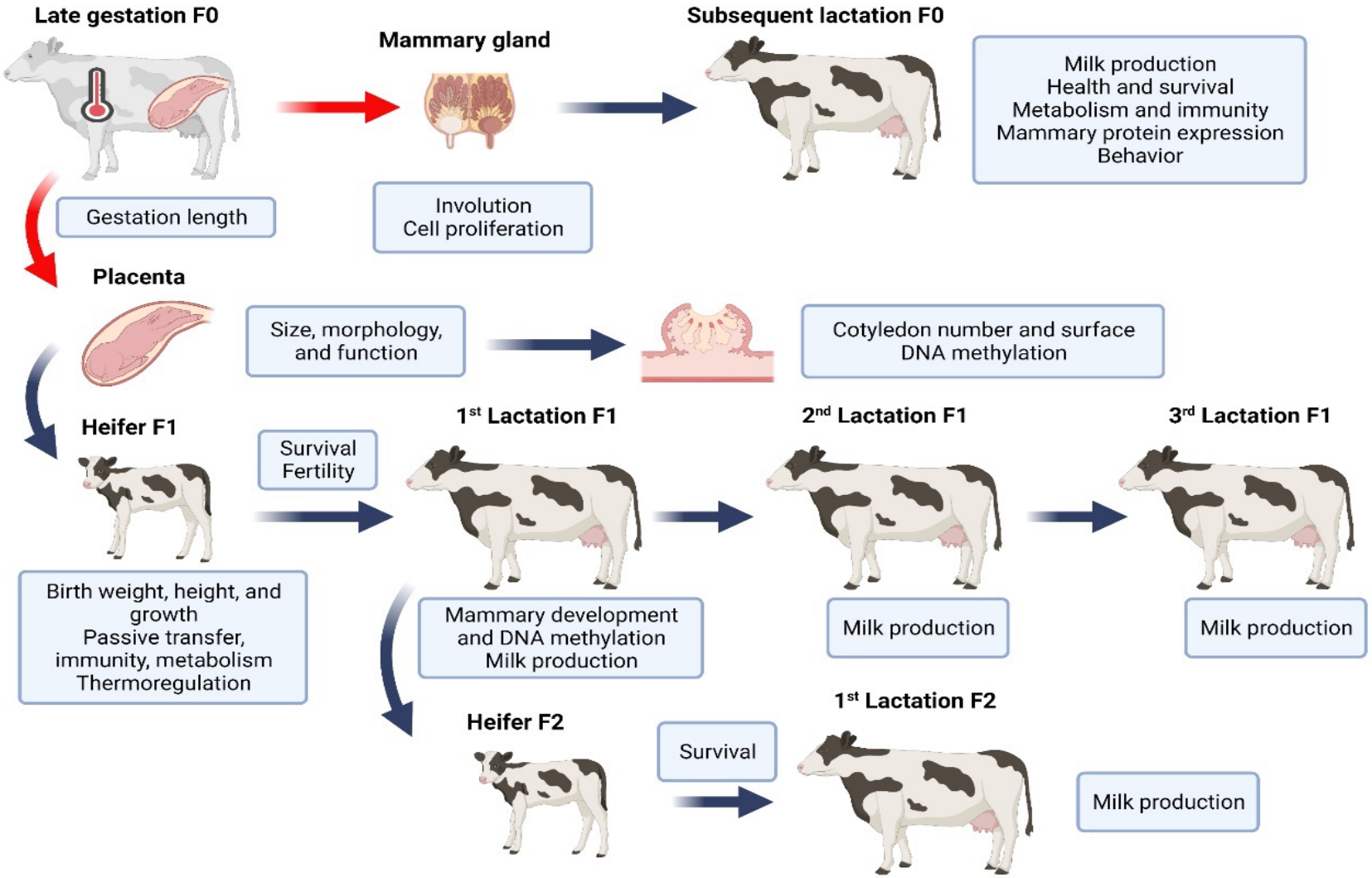
Monteiro et al., *J. Dairy Sci.* 100:1063–1071

NO EFFECT OF BETAINE SUPPLEMENTATION AND HT: CLOSE-UP

	Treatment			*P*-value		
Parameter	BET	CON	SEM	Treatment	Time	Treatment × time
BW, kg	656	696	19	0.14	<0.01	0.84
BCS	3.23	3.35	0.06	0.19	<0.01	0.01
DMI, prepartum, kg/d	13.7	13.8	0.94	0.93	<0.14	0.53
DMI, postpartum, kg/d	22.2	21.9	1.41	0.89	<0.01	0.94
Glucose, mg/dL	59.1	61.5	3.8	0.67	0.01	0.89
NEFA, μEq/L	353	298	40	0.80	<0.01	0.61
BHB, mg/L	9.6	8.5	0.65	0.26	0.01	0.29
Milk yield, kg/d	43.2	40.9	2.06	0.46	<0.01	0.81
3.5% FCM, kg/d	46.6	45.9	2.88	0.86	0.04	0.50
ECM, kg/d	44.8	44.2	2.53	0.86	0.06	0.41
FE (FCM/DMI)	2.15	2.07	0.14	0.68	<0.01	0.80
FE (ECM/DMI)	2.08	1.99	0.11	0.58	0.01	0.66
EB,[1] Mcal	−4.57	−4.18	1.59	0.86	<0.01	0.89
Milk composition						
Fat, %	4.21	4.20	0.23	0.92	<0.01	0.86
Fat, kg/d	1.72	1.75	0.13	0.88	0.25	0.60
Protein, %	2.80	2.86	0.04	0.25	<0.01	0.52
Protein, kg/d	1.17	1.15	0.05	0.75	0.10	0.62
Lactose, %	4.73	4.64	0.05	0.23	<0.01	<0.01
Lactose, kg/d	2.03	1.90	0.10	0.38	<0.01	0.15
SNF, %	8.53	8.39	0.11	0.36	<0.01	0.56
SNF, kg/d	3.62	3.44	0.17	0.45	<0.01	0.24
MUN, mg/dL	9.61	8.15	0.56	0.08	0.97	0.89
SCS	2.6	2.9	0.7	0.75	0.25	0.05

[1]Energy balance during early lactation.

Monteiro et al., *J. Dairy Sci.* 100:1063–1071


Late gestation F0
Mammary gland
Subsequent lactation F0
Milk production
Health and survival
Metabolism and immunity
Mammary protein expression
Behavior
Gestation length
Involution
Cell proliferation
Placenta
Size, morphology, and function
Cotyledon number and surface DNA methylation
Heifer F1
Survival
Fertility
1st Lactation F1
2nd Lactation F1
3rd Lactation F1
Birth weight, height, and growth
Passive transfer, immunity, metabolism
Thermoregulation
Mammary development and DNA methylation
Milk production
Milk production
Milk production
Heifer F2
Survival
1st Lactation F2
Milk production

THANKS!

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- Dr. Sally Johnson – Virginia Tech

NSF

USDA

United States Department of Agriculture

National Institute of Food and Agriculture

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