

Can Dairy Cows Eat Their Way to Better Reproduction?

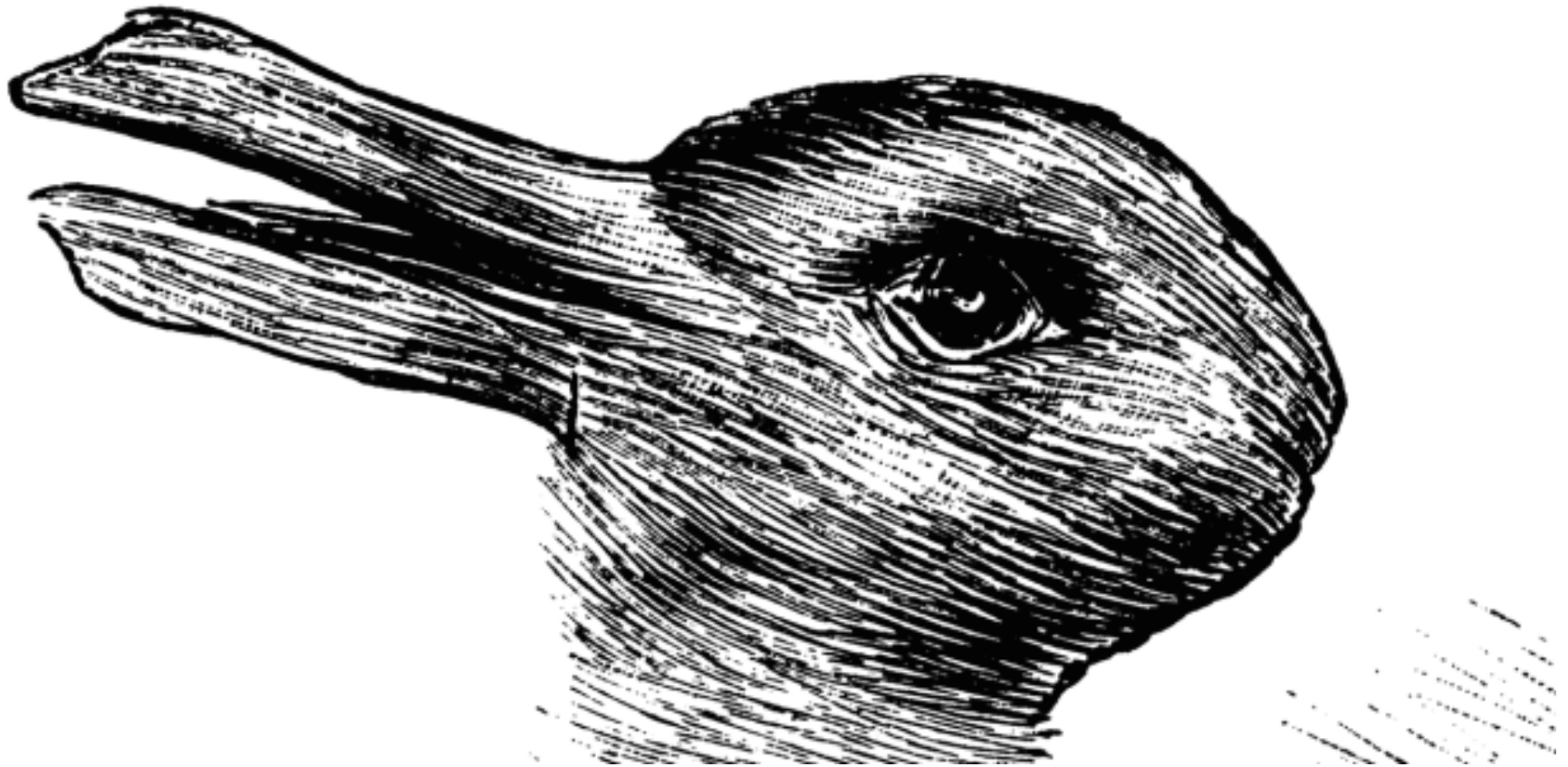
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**The way you look at
something matters**



Nutrition and Reproduction

The first view:

Dairy cows are lacking some essential nutrient that is limiting reproductive efficiency.

SYMPOSIUM: OPTIMIZING ENERGY NUTRITION FOR REPRODUCING DAIRY COWS

Influence of Supplemental Fats on Reproductive Tissues and Performance of Lactating Cows¹

1998 J Dairy Sci 81:856–871

C. R. STAPLES,² J. M. BURKE, and W. W. THATCHER

Department of Dairy and Poultry Sciences,
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Review of **20 experiments** reporting the effect of feeding fat on reproductive performance.

“Has the reproductive performance of lactating dairy cows been improved by the inclusion of supplemental fat in the diet? **The results are mixed.** Of the studies reporting conception or pregnancy rate data, **11 studies reported an improvement either in first AI service conception rate or in the overall rate of conception or pregnancy.**”

Nutrition and Reproduction

Three experiments:

Feeding omega-3 fat (flax)

Bork et al., 2010; J. Anim. Sci. 88:3739-3748

Feeding chelated trace minerals

Hackbart et al., 2010; J. Anim. Sci. 88:3856-3870

Feeding rumen-protected choline

Amundson et al., 2013; J. Dairy Sci. 96(Suppl. 1):100

Nutrition and Reproduction

The first view:

Dairy cows are lacking some essential nutrient that is limiting reproductive efficiency.

As of today, I have yet to feed anything to dairy cows that has significantly improved reproduction.

Nutrition and Reproduction

The second view:

Changes in body condition score or body weight early after calving affect subsequent reproductive performance.



J. Dairy Sci. 97:3666–3683

<http://dx.doi.org/10.3168/jds.2013-7809>

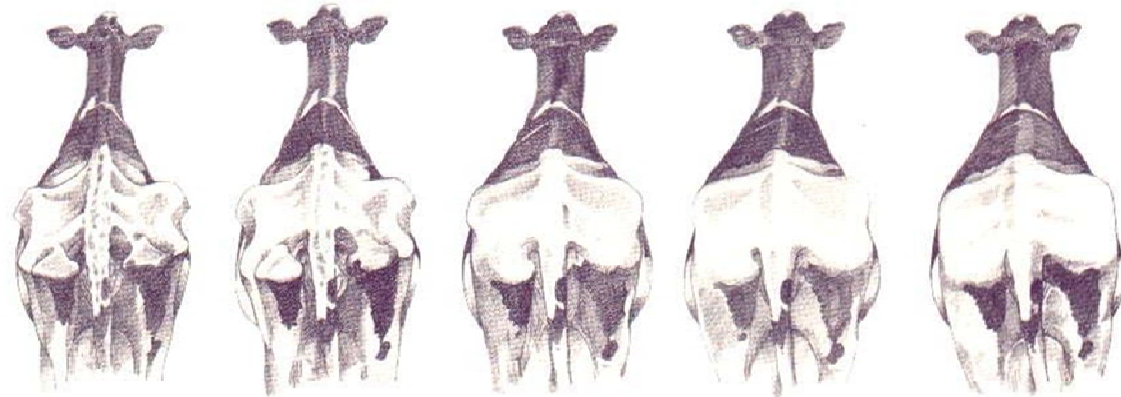
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Relationships between fertility and postpartum changes in body condition and body weight in lactating dairy cows

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Three Experiments:

1. Effect of body condition score (**BCS**) near AI on pregnancies per AI (**P/AI**) at first timed artificial insemination (**TAI**)
2. Effect of BCS change early postpartum on P/AI at first TAI
3. Effect of Body Weight change early postpartum on embryo quality at first TAI

Genetic parameters for anovulation and pregnancy loss in dairy cattle

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5,818 records from
13 studies in 8 herds
prevalence = **23.3%**



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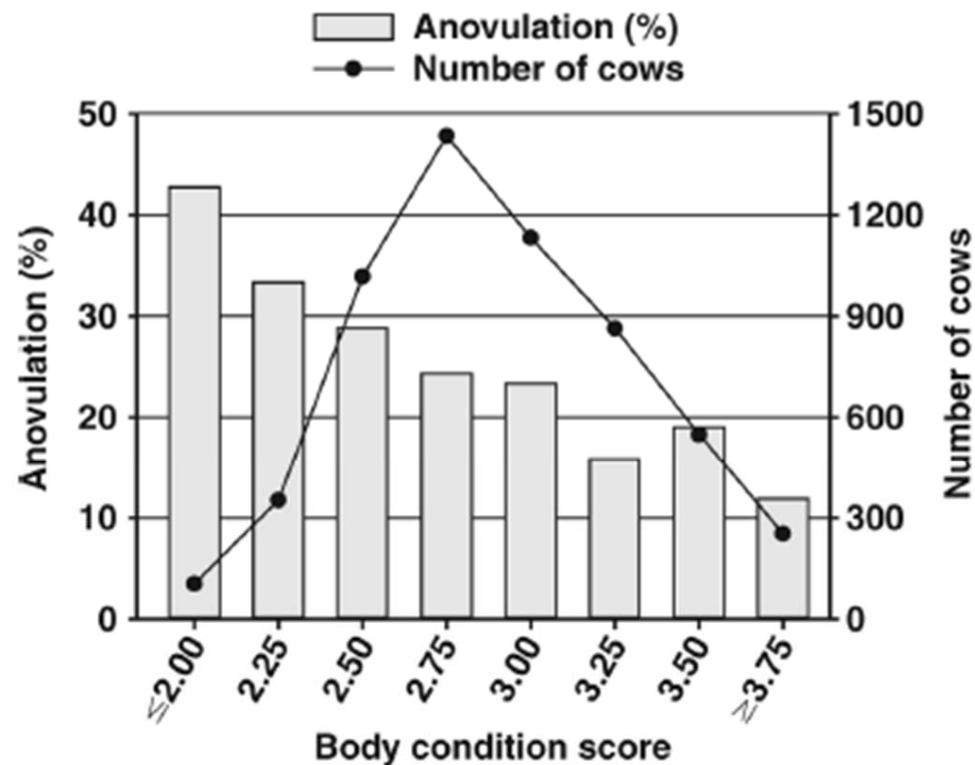


Figure 1. Observed prevalence of anovulation (bars) and number of cows (line) by category of BCS. An additional 118 records without BCS had 13.6% prevalence.

Presynch Ovsynch protocol

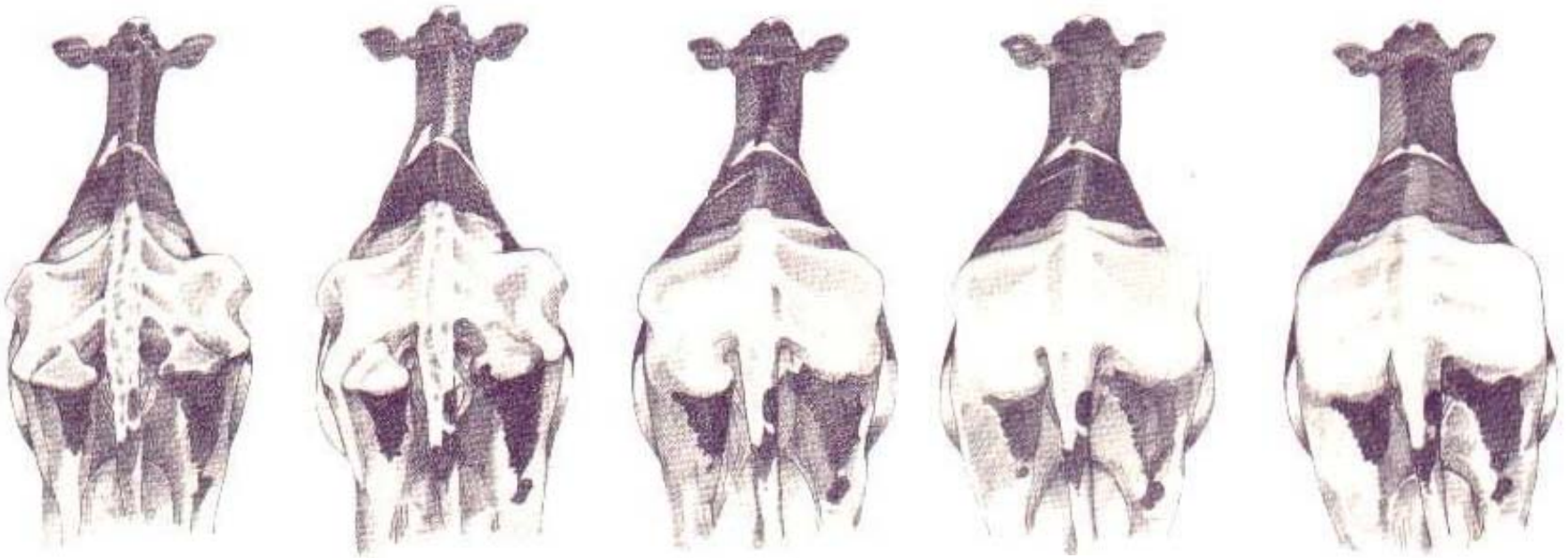
Sun	Mon	Tue	Wed	Thu	Fri	Sat
			PGF			
			PGF			
	GnRH	65 % of cows with CL				
	PGF		GnRH	TAI		

Double Ovsynch protocol

Sun	Mon	Tue	Wed	Thu	Fri	Sat
					GnRH	
					PGF	
	GnRH					
	GnRH	95 % of cows with CL				
	PGF		GnRH	TAI		

Experiment 1:

Does BCS near AI affect fertility to first TAI?



Cows with low BCS near AI will have decreased fertility at first TAI

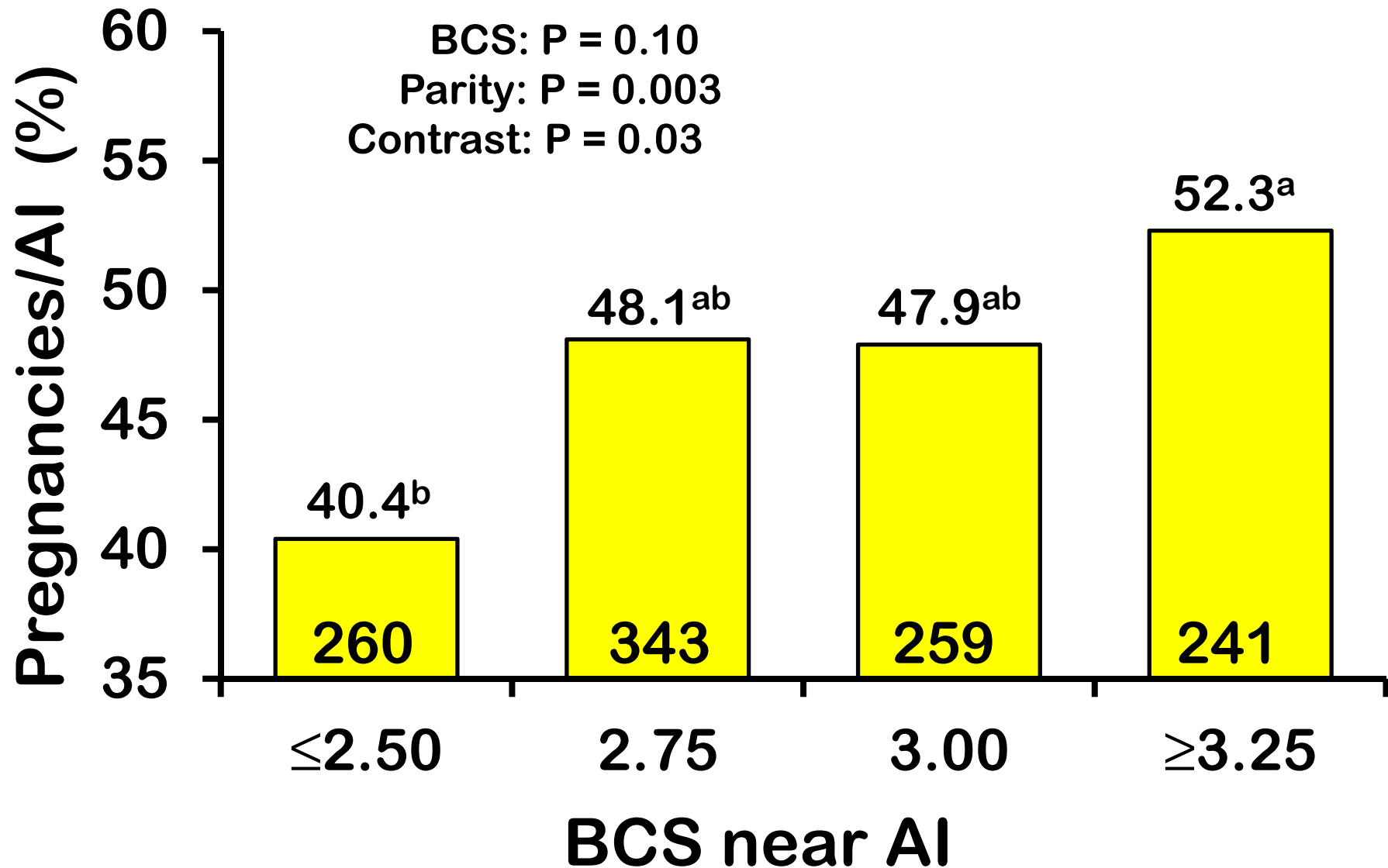
Materials & Methods

- 1,103 lactating dairy cows from 4 farms in Wisconsin
 - 481 cows with one pregnancy diagnosis
 - 622 two pregnancy diagnosis and pregnancy loss, blood sample collected at G1 for P4 assay
- BCS evaluated near AI using a 5 point scale with 0.25 increments (Edmonson et al., 1989)

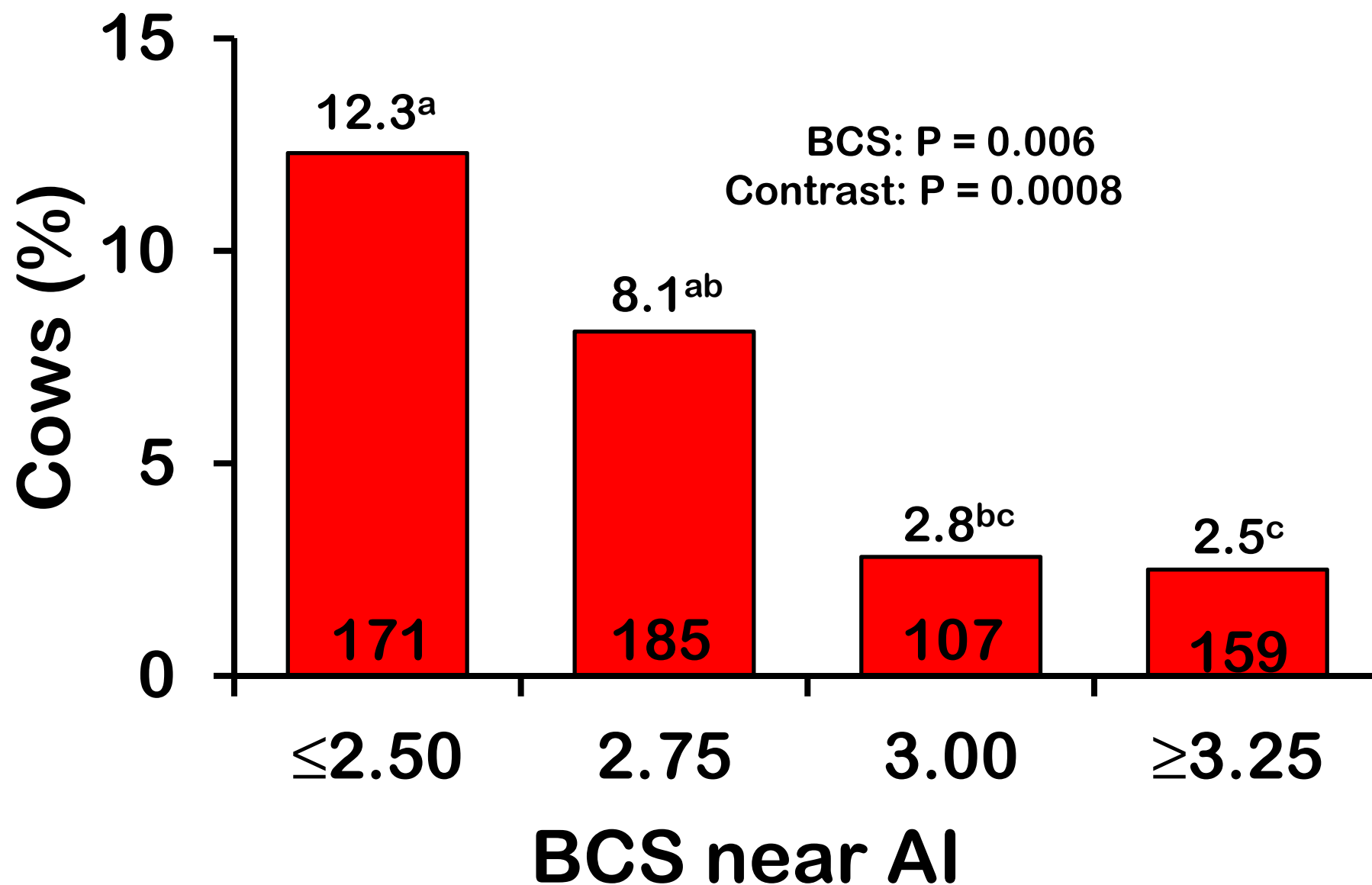
≤ 2.50 ; 2.75; 3.00, ≥ 3.25

Low (≤ 2.50) vs. **high** (≥ 2.75)

Pregnancies/AI at 40 d – All cows

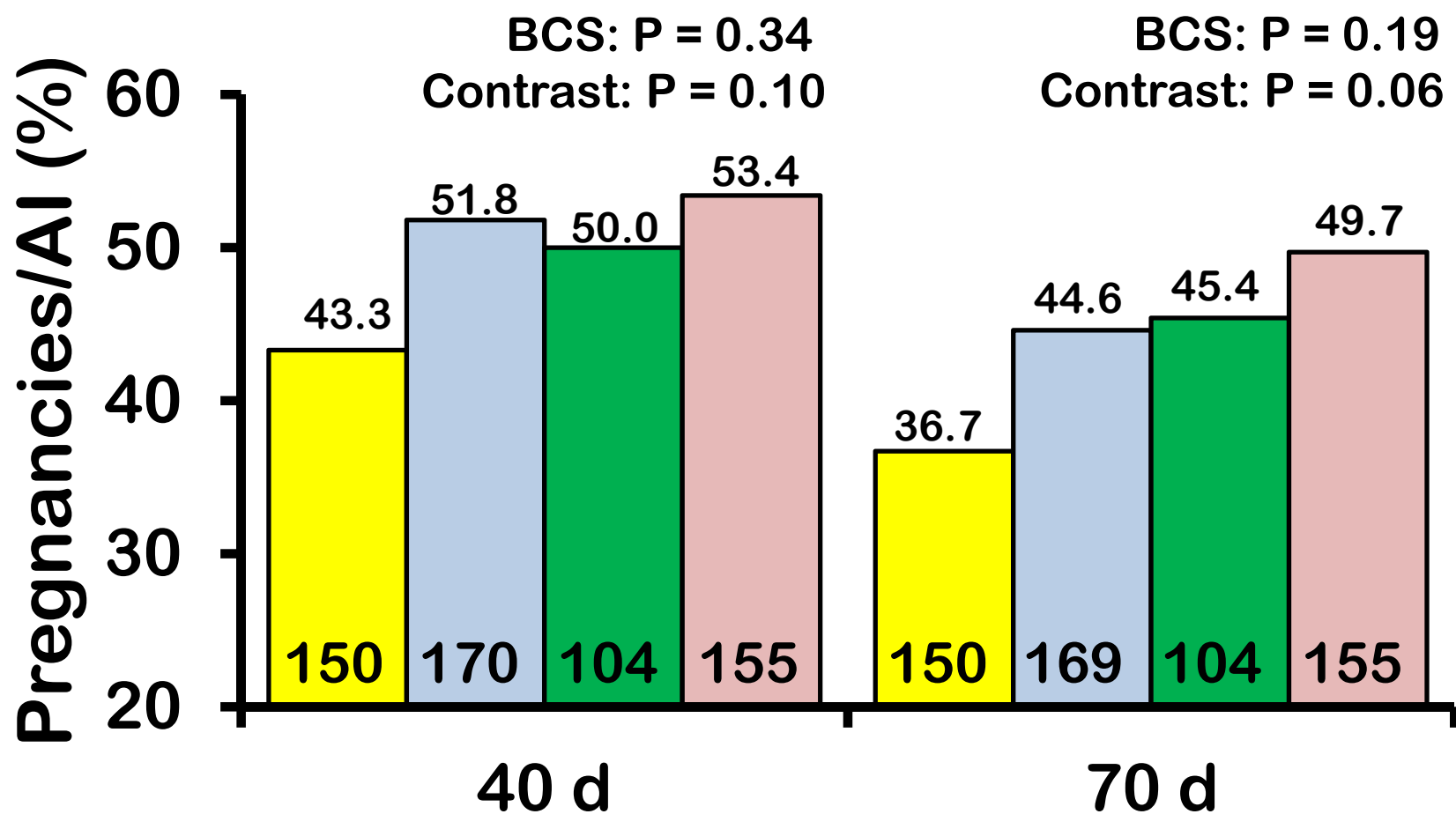


Cows with P4 < 0.5 ng/mL at G1

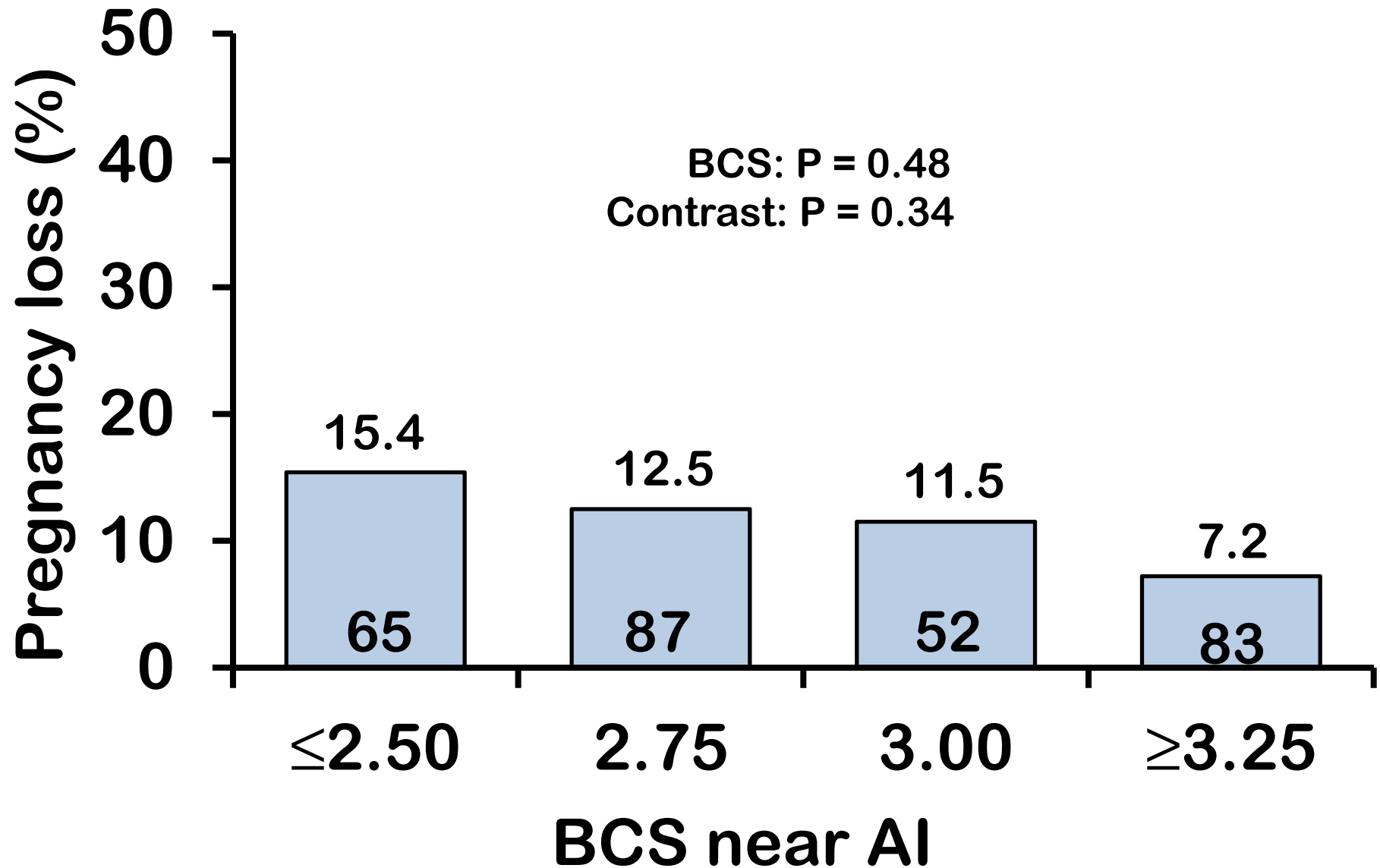


Pregnancies/AI for Cows with P4 >0.5 ng/mL

■ BCS ≤ 2.50 ■ BCS = 2.75 ■ BCS = 3.00 ■ BCS ≥ 3.25

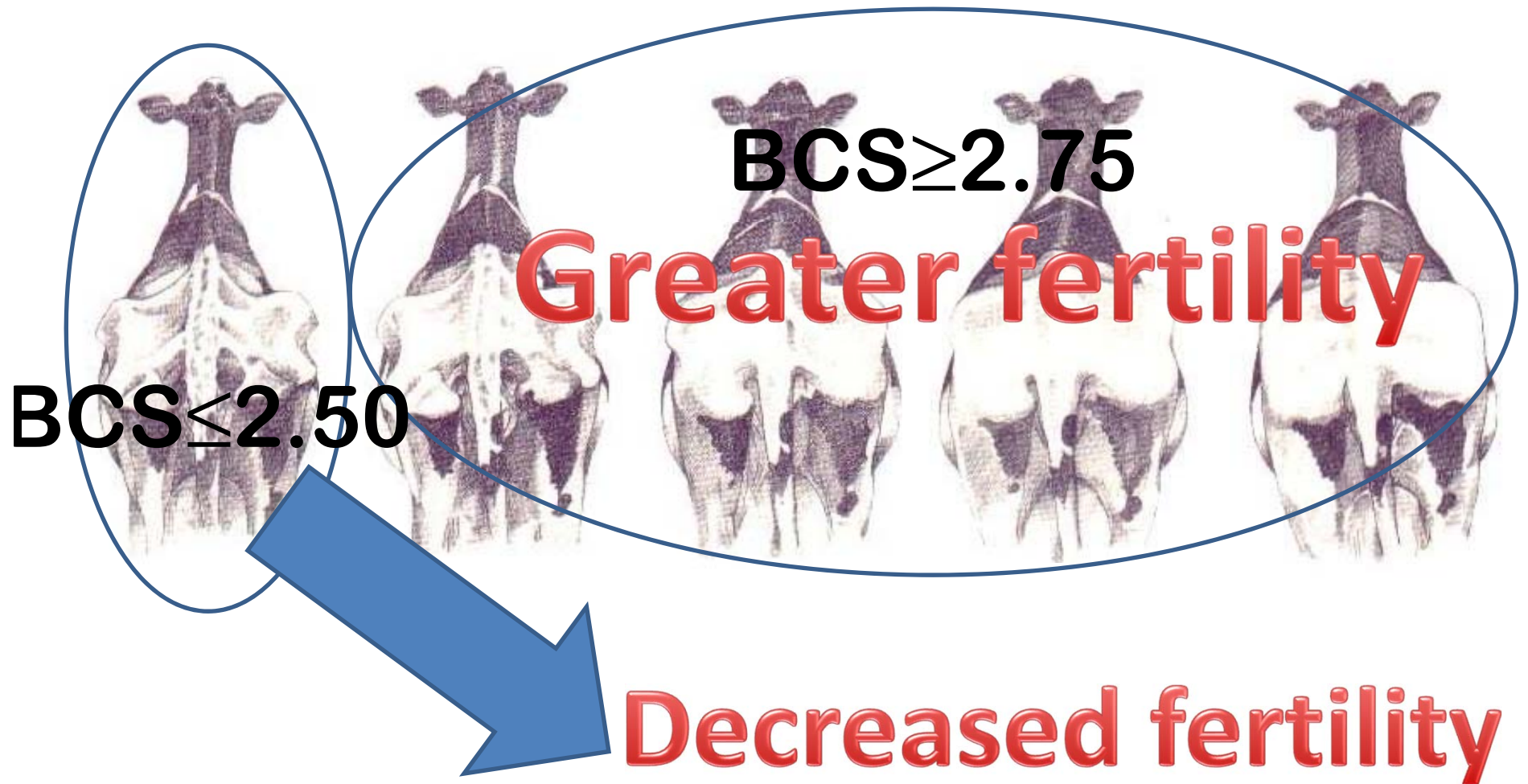


Pregnancy Loss



Experiment 1:

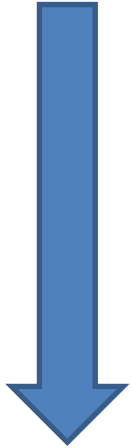
Does BCS near AI affect fertility to first TAI?



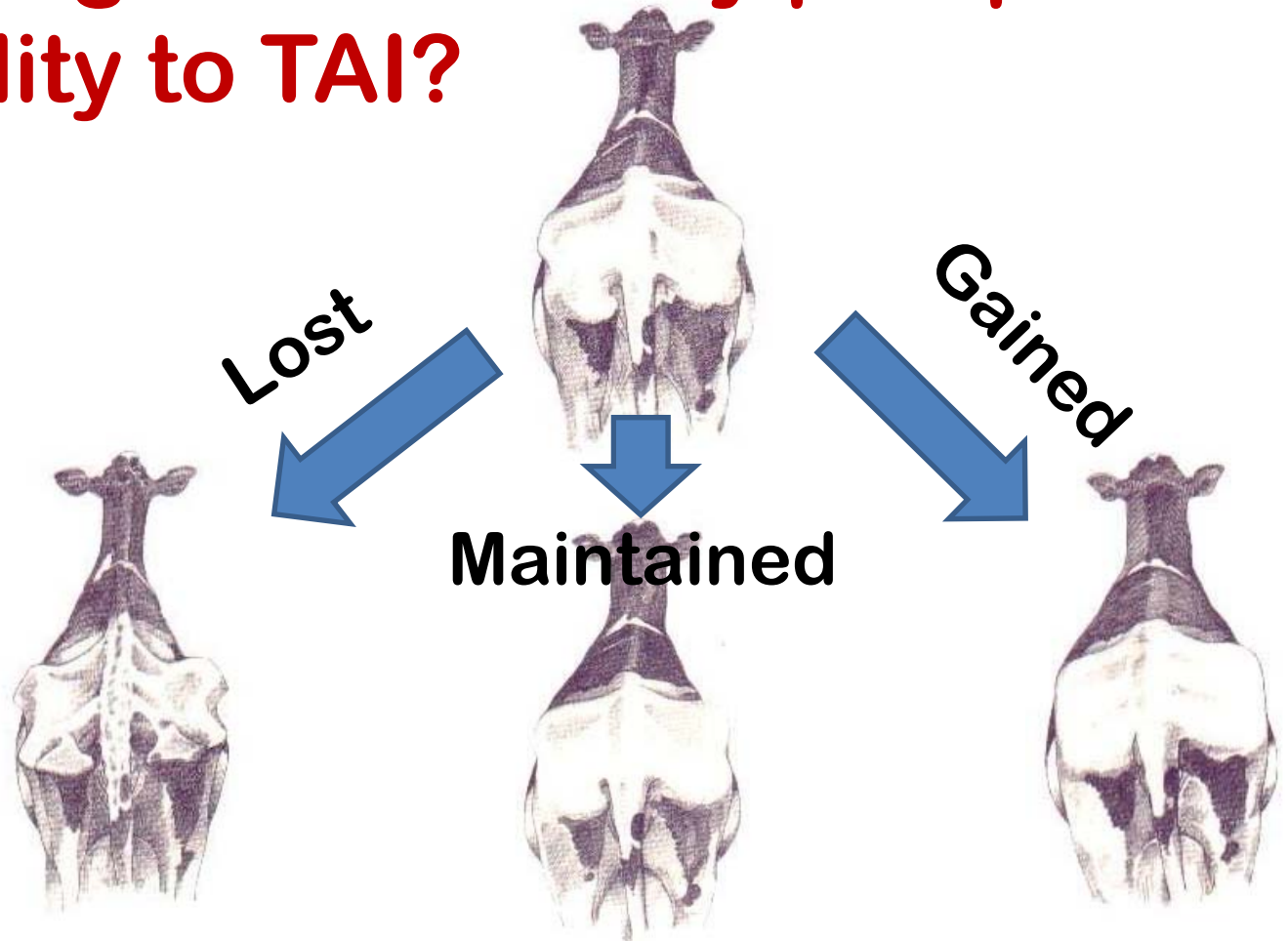
Experiment 2:

Does a change in BCS early postpartum affect fertility to TAI?

Calving



21 DIM



Cows losing more BCS early postpartum will have decreased fertility at first TAI

Materials & Methods

- 1,887 lactating Holstein cows from 2 commercial dairies in Wisconsin
All cows were synchronized for 1st TAI using a Double Ovsynch protocol
- BCS evaluated at calving and 21 d later using a 5 point scale with 0.25 increments (Edmonson et al., 1989)
- $\text{BCS change} = \text{BCS 21DIM} - \text{BCS calving}$

% of cows, BCS at calving and 21 DIM

All Cows

	BCS Change			P-Value
	Lost	Maintained	Gained	BCS
% cows	41.8 (789/1887)	35.8 (675/1887)	22.4 (423/1887)	-
% Primi.	47.3 (373/789)	52.7 (356/675)	55.1 (233/423)	0.02
BCS at calving	2.93±0.01 ^a	2.89±0.02 ^{ab}	2.85±0.02 ^b	0.005
BCS at 21 DIM	2.64±0.01 ^c	2.89±0.02 ^b	3.10±0.02 ^a	<0.001
BCS Δ	-0.29	0.0	+0.25	
Milk (lb) ¹	63.8±0.4	62.7±0.4	63.4±0.7	0.23

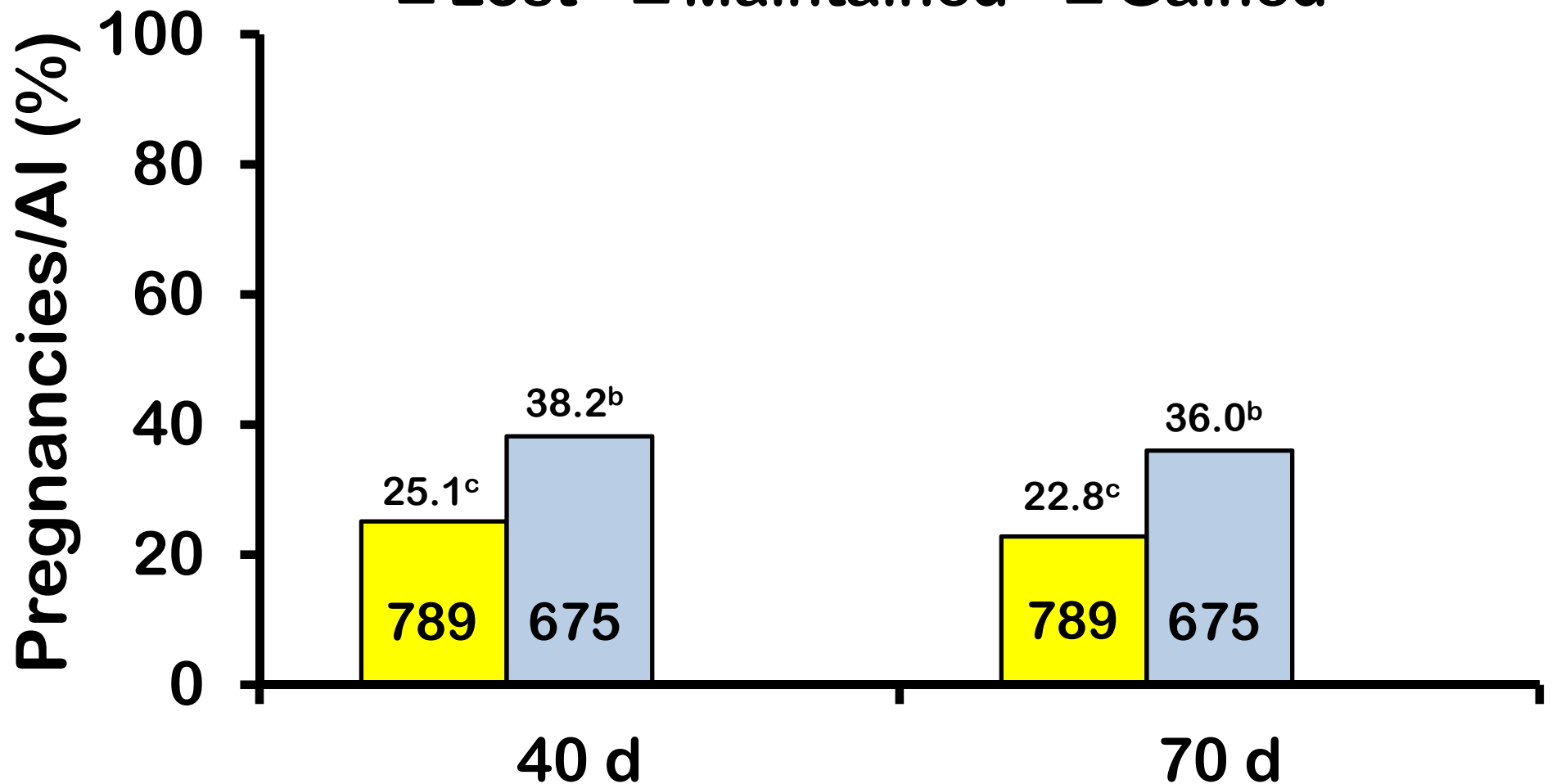
¹From calving to 21DIM

Pregnancies/AI

BCS change: $P < 0.001$
Parity: $P < 0.001$

BCS change: $P < 0.001$
Parity: $P < 0.001$

■ Lost ■ Maintained ■ Gained

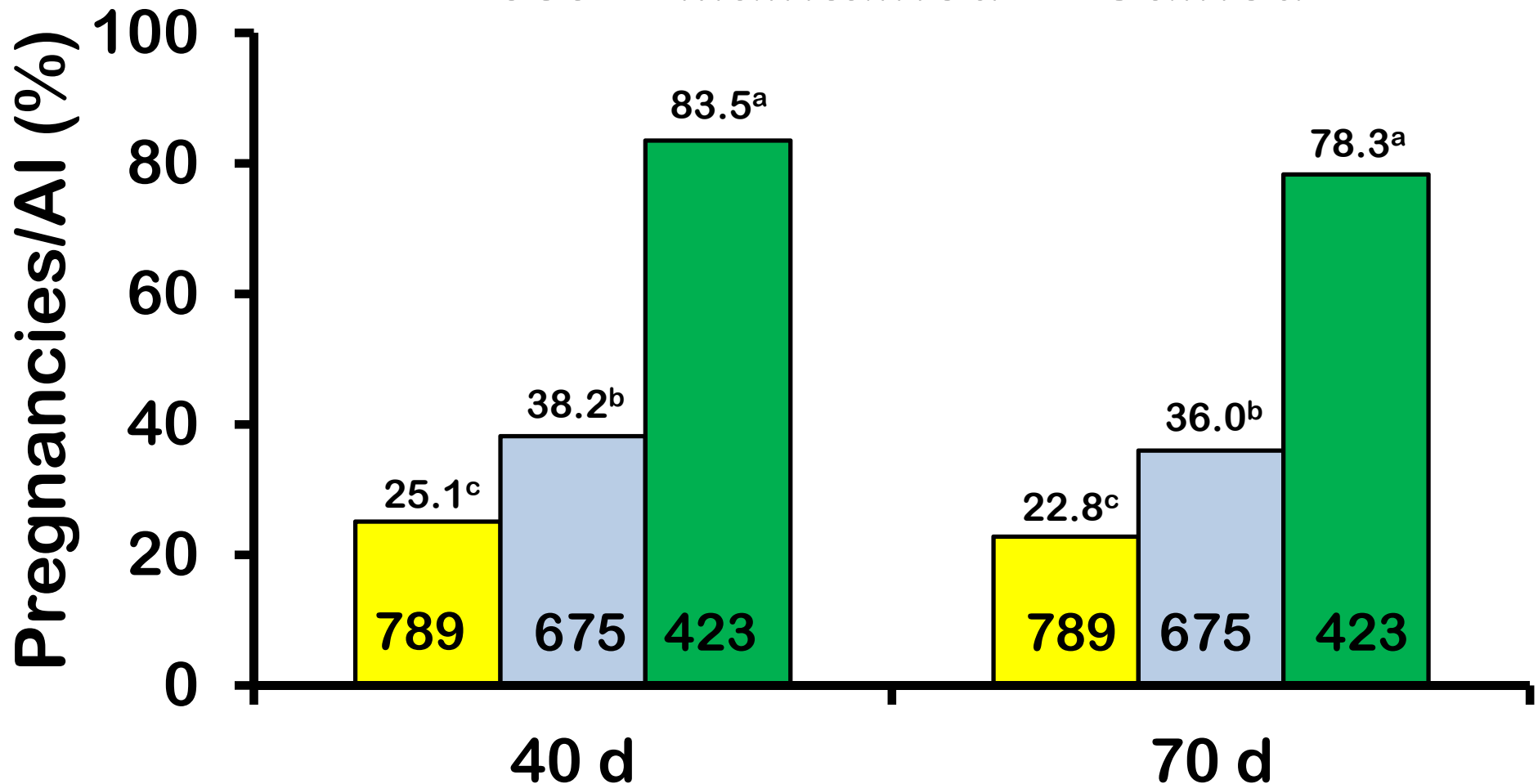


Pregnancies/AI

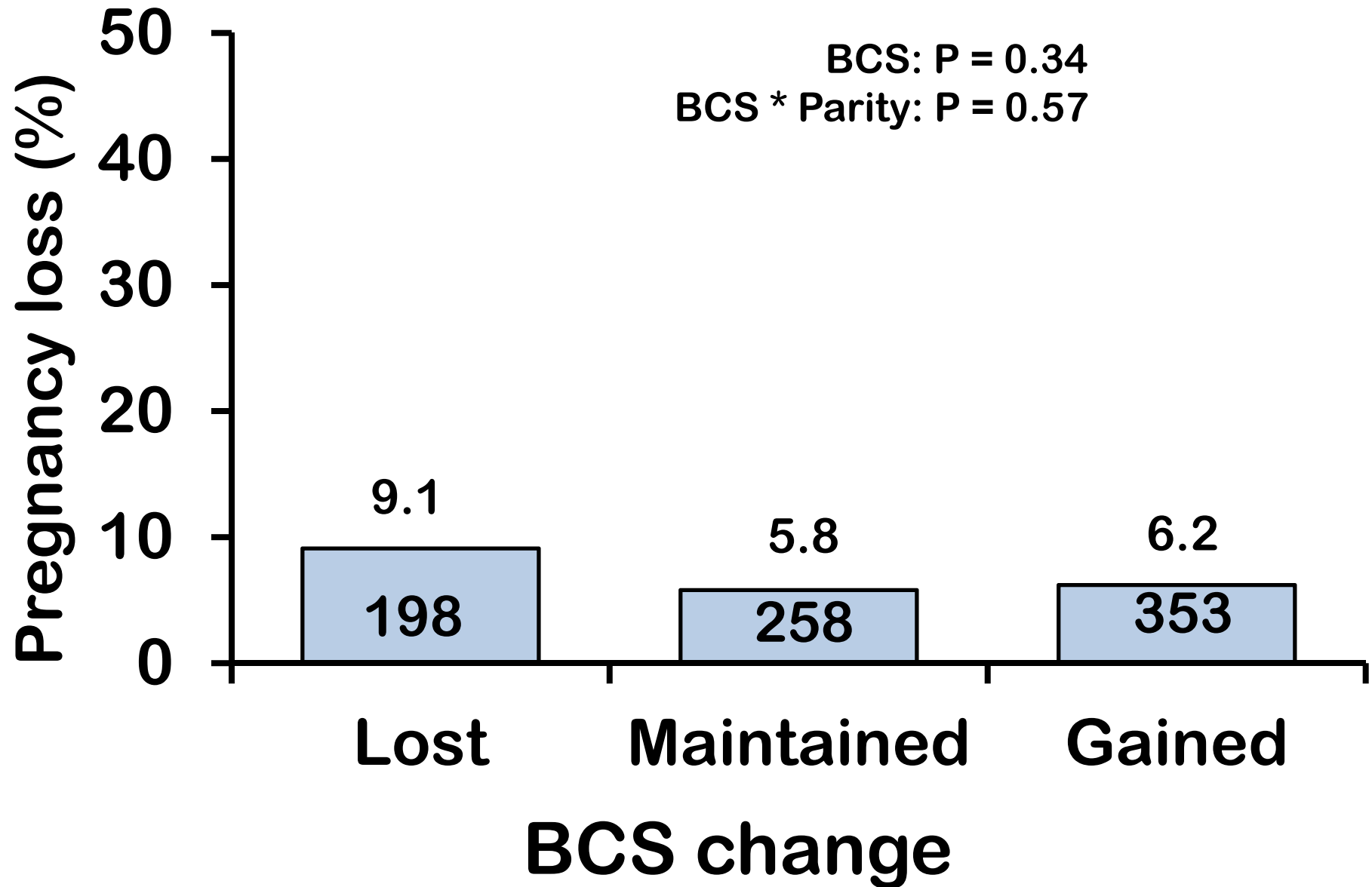
BCS change: $P < 0.001$
Parity: $P < 0.001$

BCS change: $P < 0.001$
Parity: $P < 0.001$

■ Lost ■ Maintained ■ Gained



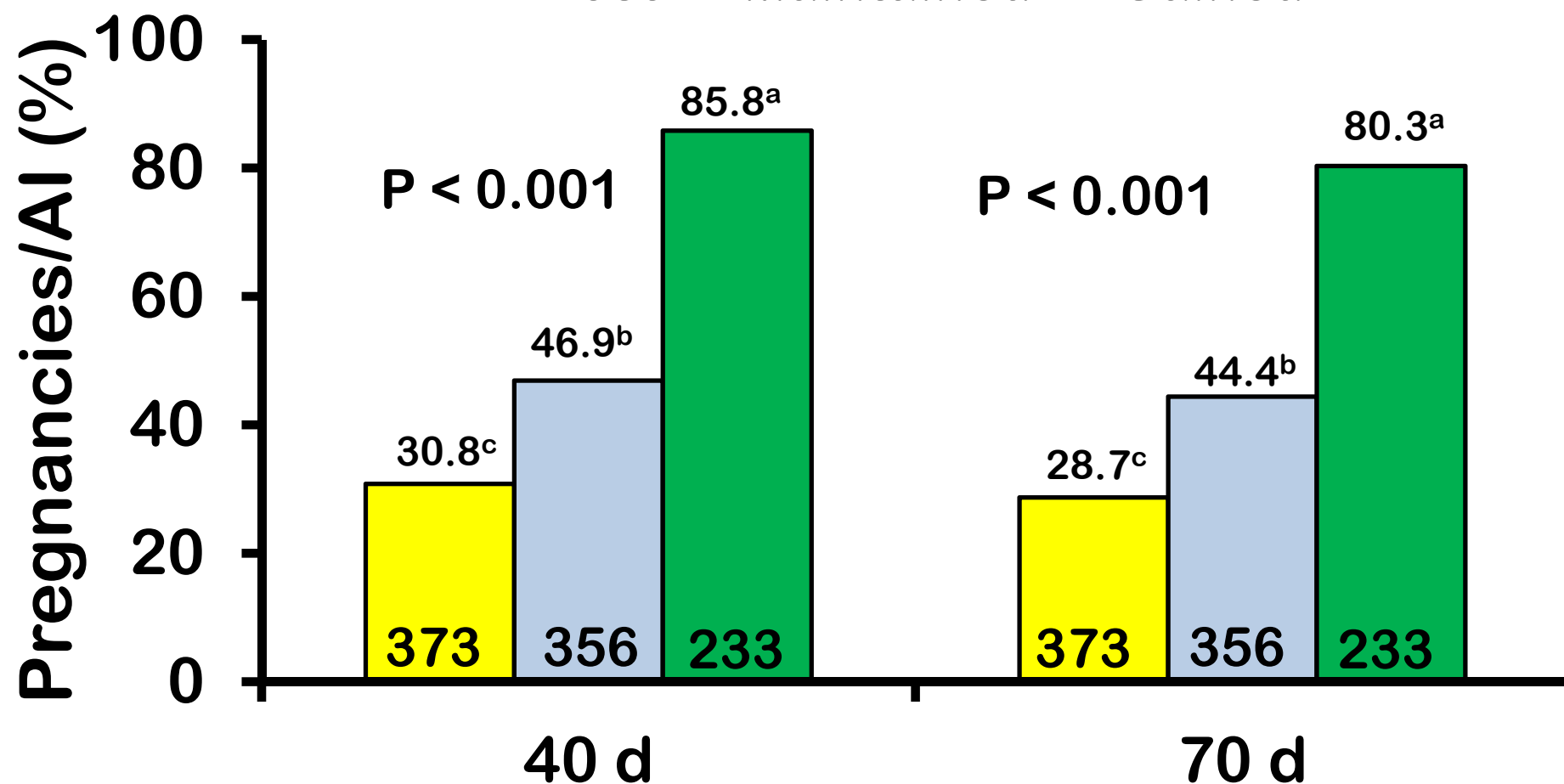
Pregnancy Loss



Pregnancies/AI

Primiparous cows

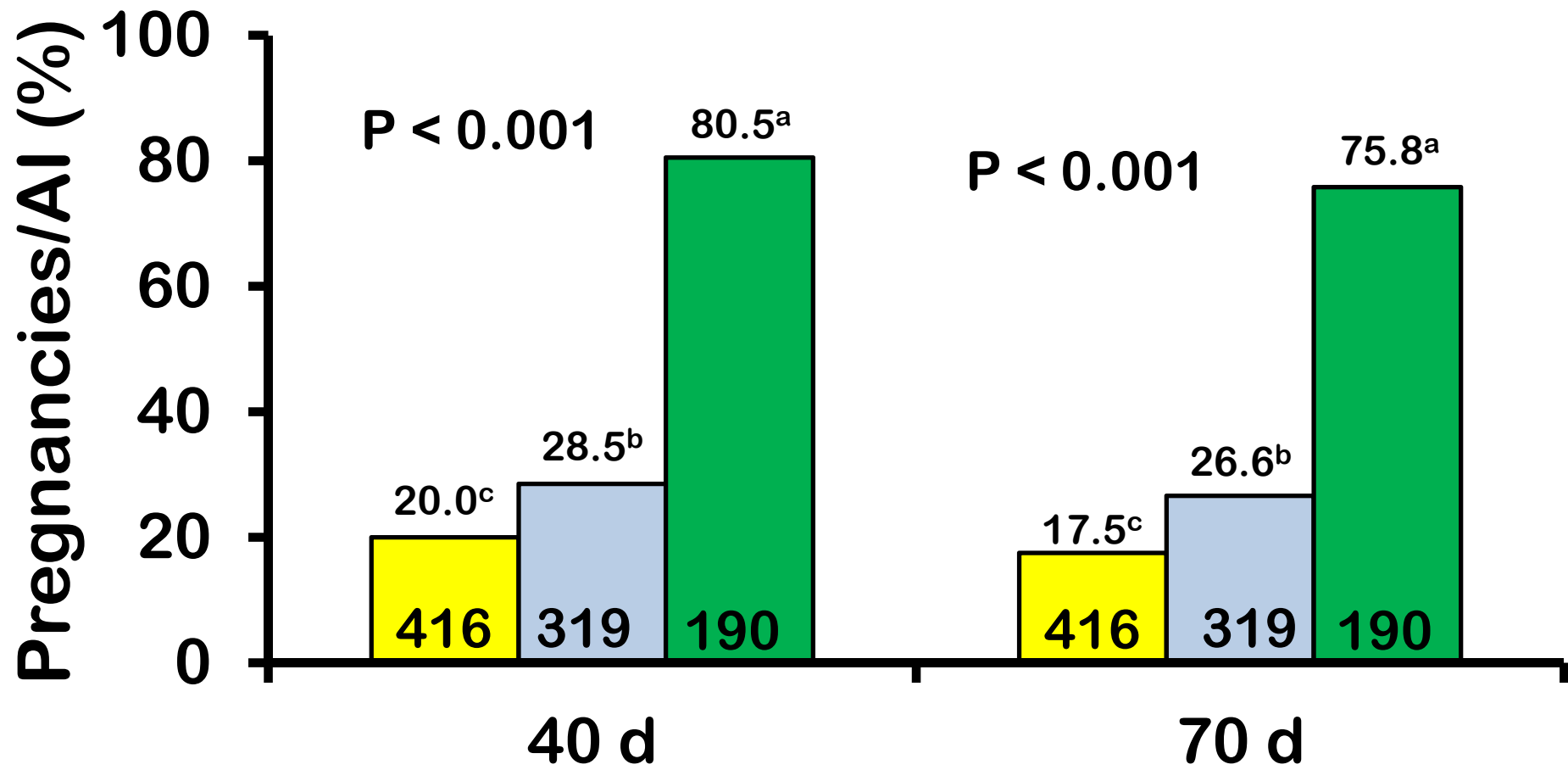
■ Lost ■ Maintained ■ Gained



Pregnancies/AI

Multiparous cows

■ Lost ■ Maintained ■ Gained



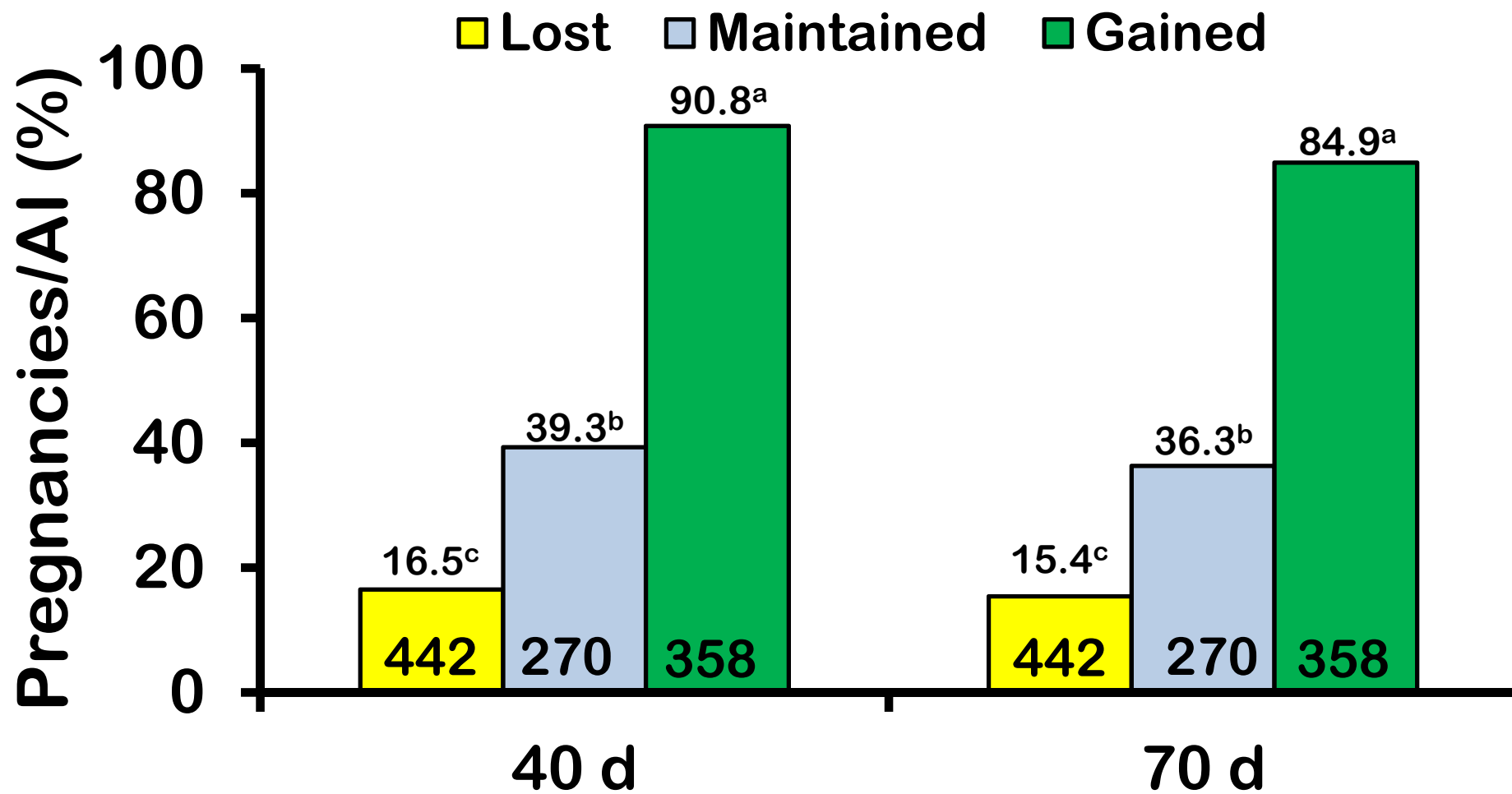
Pregnancies/AI – Farm 1

BCS change: $P < 0.001$

Parity: $P = 0.04$

BCS change: $P < 0.001$

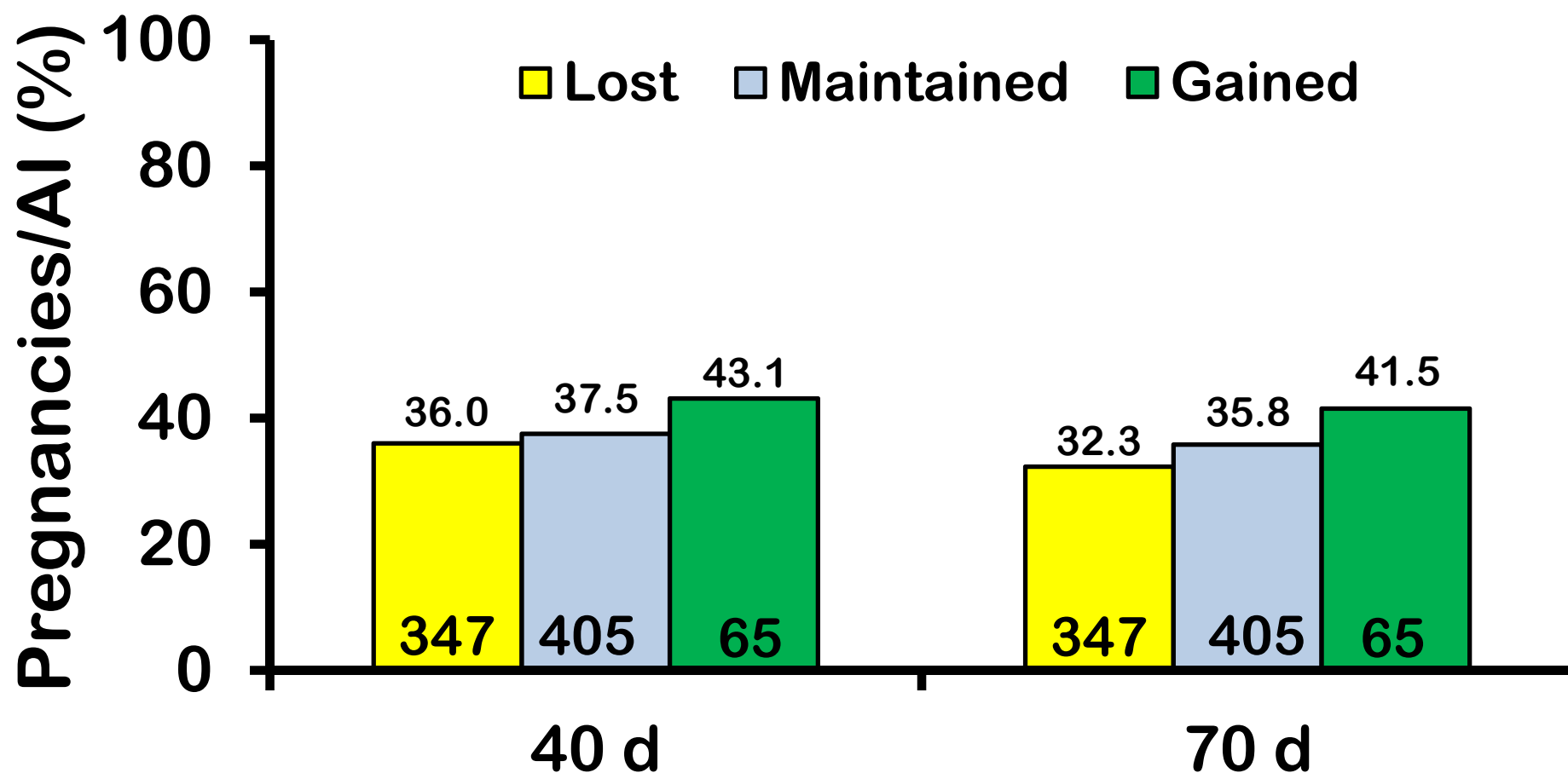
Parity: $P = 0.02$



Pregnancies/AI – Farm 2

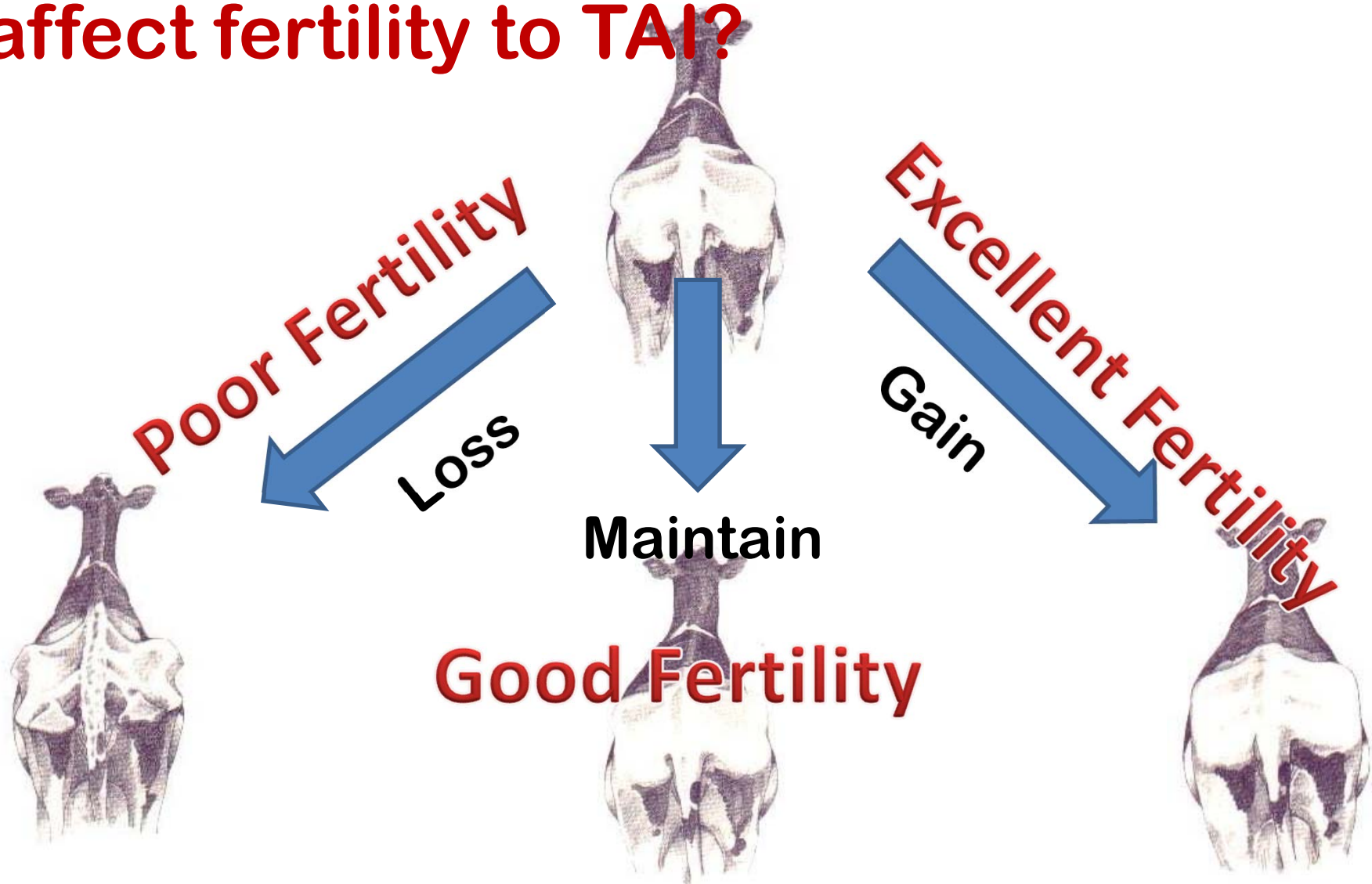
BCS change: $P = 0.60$
Parity: $P < 0.001$

BCS change: $P = 0.35$
Parity: $P < 0.001$



Experiment 2:

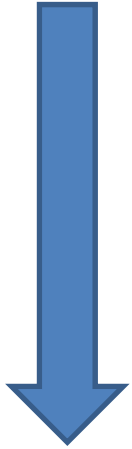
Does a change in BCS early postpartum affect fertility to TAI?



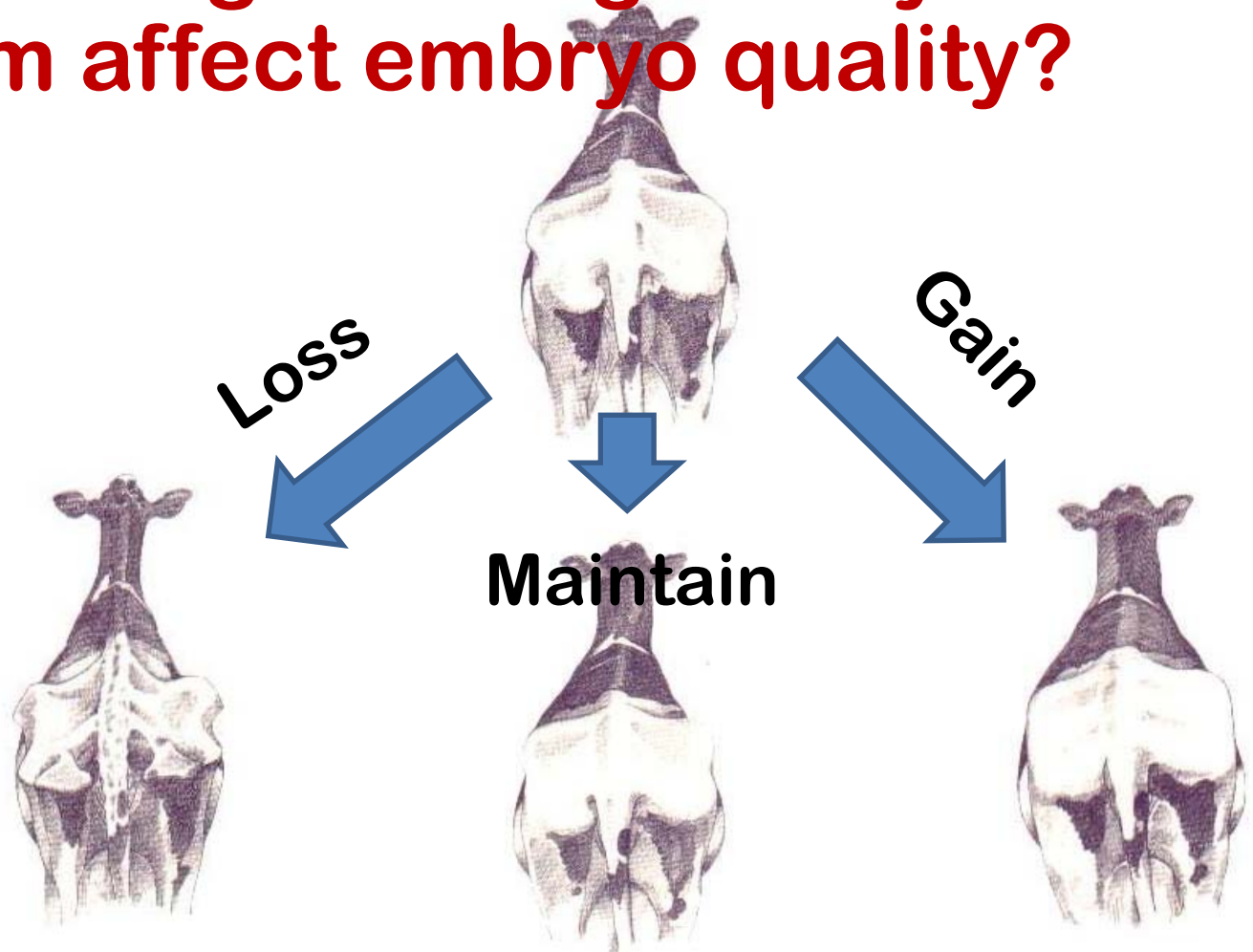
Experiment 3:

Does Body Weight change early postpartum affect embryo quality?

Calving



21 DIM

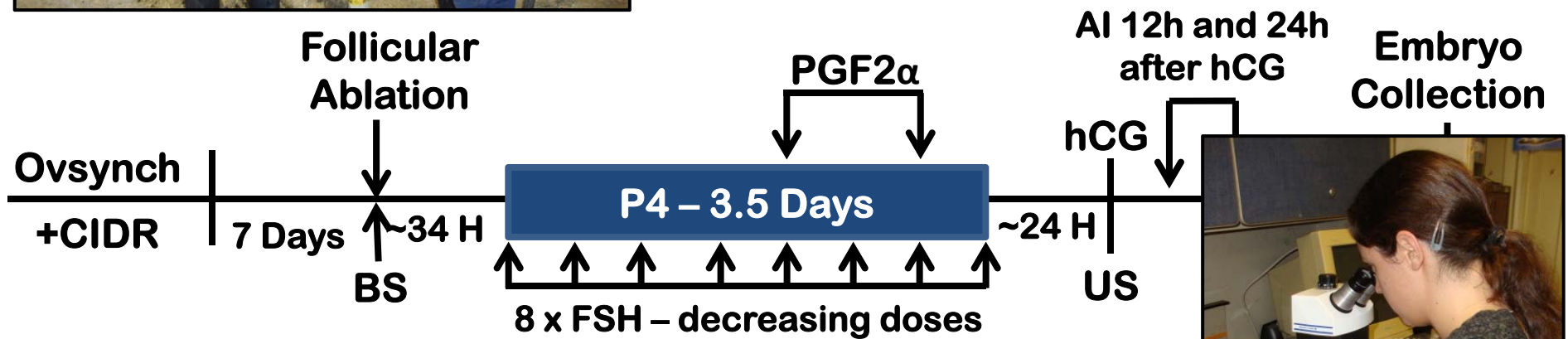


Cows losing more BW early postpartum will have poor embryo quality

Materials & Methods



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and supers

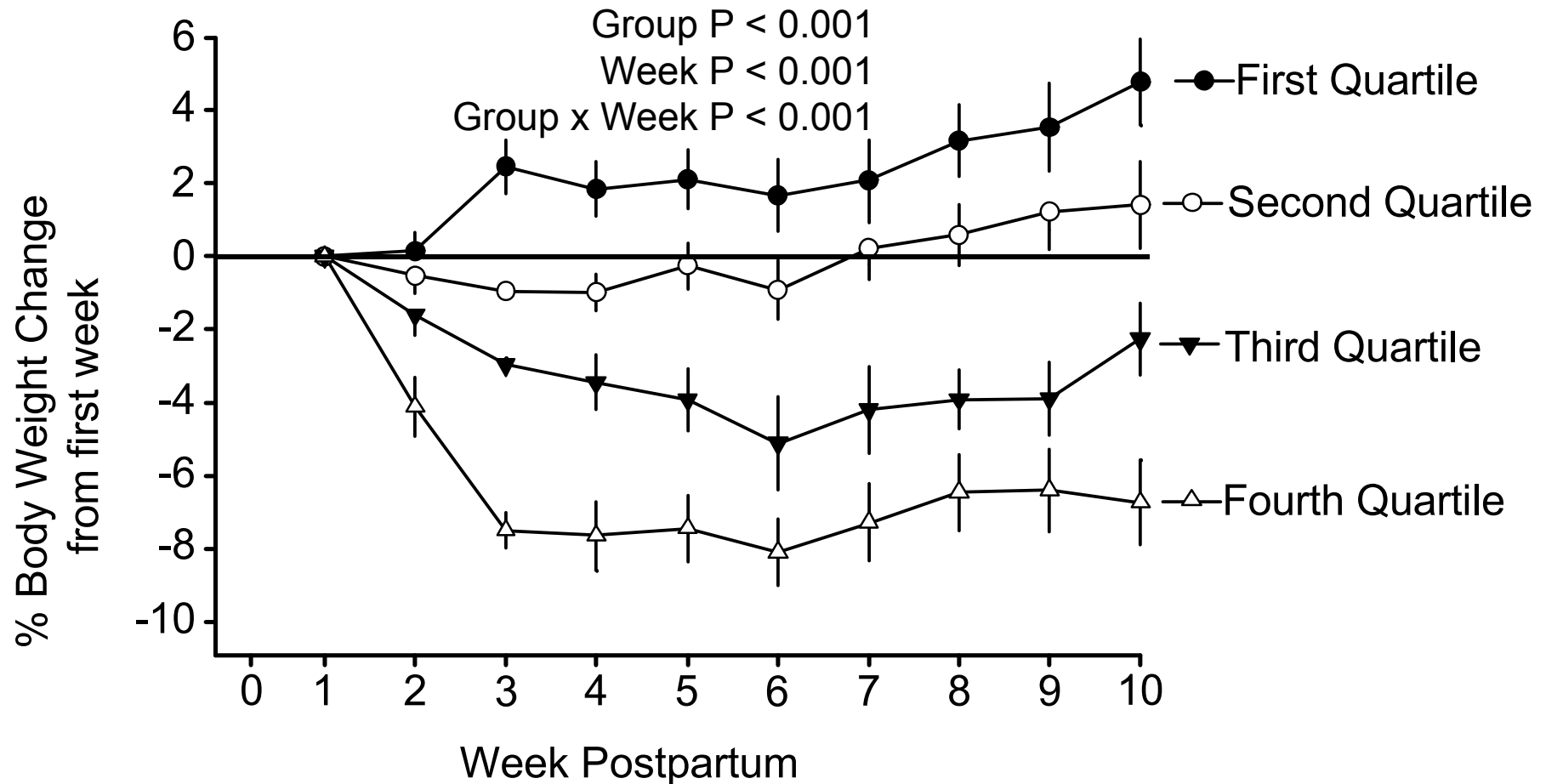


Materials & Methods

Body weight was measured weekly from calving to 70 DIM

Cows were divided into quartiles based on % body weight change from first to third week postpartum

% Body weight change



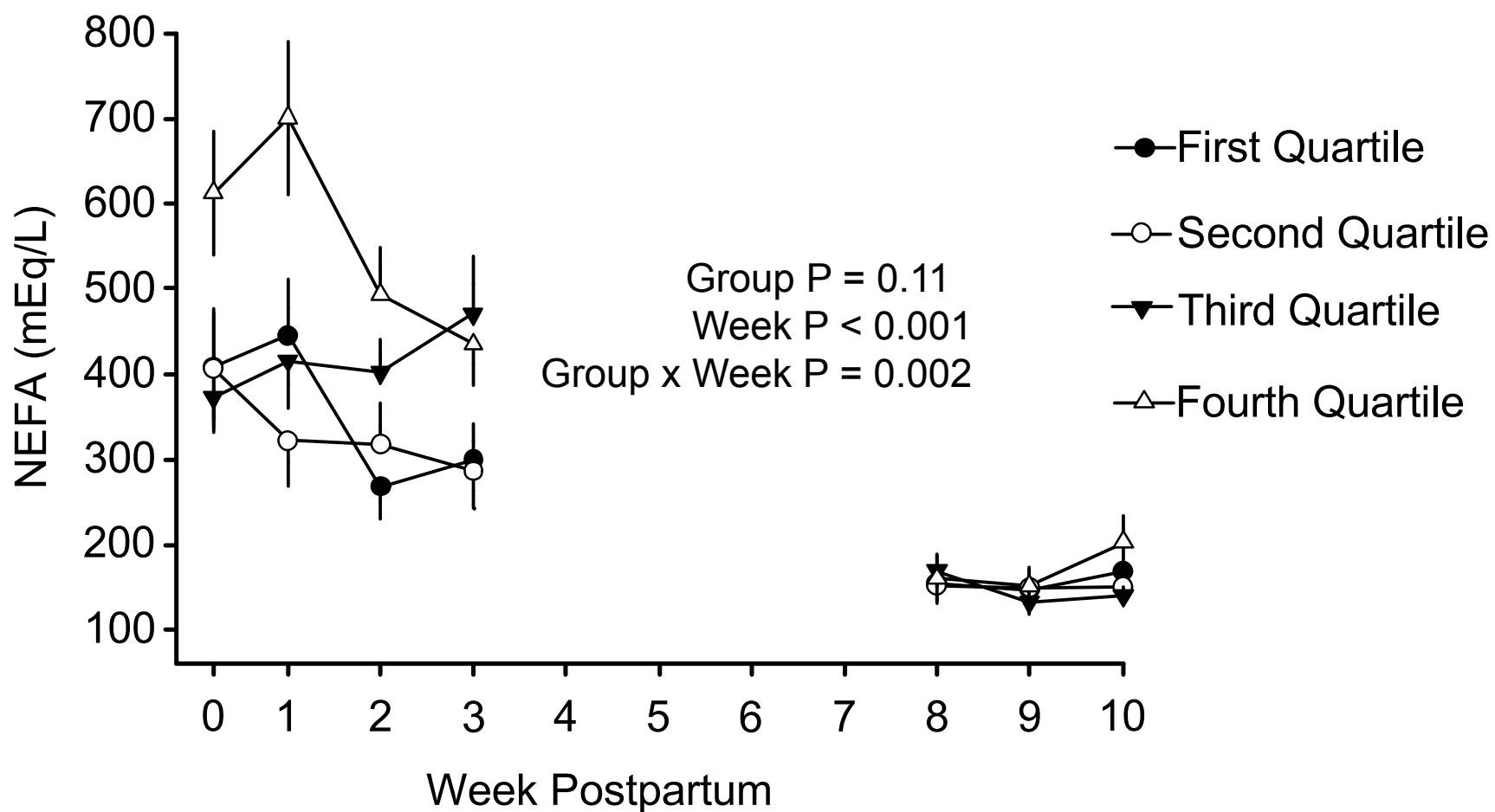
Body Weight (kg)

	Quartile				P-value
	Fourth Q Lost +	Third Q Lost	Second Q Maintain	First Q Gain	
n	17	16	17	16	
Primiparous	4 (24%)	6 (38%)	8 (47%)	8 (50%)	0.44
Initial BW	644±20 ^a	639±25.3 ^a	600±19 ^a	550±17 ^b	0.03
Primmiparous	544±9	540±12	544±22	502±8	0.12
Multiparous	675±18	698±25	649±17	598±22	0.18

Body Weight (lb)

	Quartile				p-value
	Fourth Q Lost +	Third Q Lost	Second Q Maintain	First Q Gain	
n	17	16	17	16	
Primiparous	4 (24%)	6 (38%)	8 (47%)	8 (50%)	0.44
Initial BW	1,417 ± 44 ^a	1,406 ± 55 ^a	1,320 ± 42 ^a	1,210 ± 37 ^b	0.03
1 st lact.	1,197 ± 20	1,188 ± 26	1,197 ± 48	1,104 ± 18	0.12
> 1 st lact.	1,485 ± 40	1,536 ± 55	1,428 ± 37	1,316 ± 48	0.18

NEFA concentrations



Embryo Characteristics

	Quartile				P-value
	Fourth Q Lost +	Third Q Lost	Second Q Maintain	First Q Gain	
CL (no.)	18.4 ± 2.6	18.4 ± 1.7	19.0 ± 1.7	16.0 ± 2.0	0.67
Fertilized embryos (%)	76.9 ± 7.1	77.0 ± 6.6	77.6 ± 7.6	78.4 ± 7.1	0.99
Quality 1 & 2 embryos (%)	38.0 ± 8.7	61.3 ± 8.2	60.6 ± 9.4	63.4 ± 8.6	0.14
Degenerate embryos (%)	35.2 ± 8.5 ^a	12.6 ± 4.6 ^b	14.5 ± 6.3 ^b	9.6 ± 3.7 ^b	0.02
Qual 1 & 2 of Fertilized (%)	48.4 ± 9.5 ^a	78.3 ± 6.6 ^b	72.6 ± 9.5 ^b	77.7 ± 7.4 ^b	0.05
Degenerate of Fertilized (%)	46.9 ± 9.6 ^{a,A}	17.4 ± 6.4 ^{b,B}	24.8 ± 9.3 ^{ab,A}	16.2 ± 7.0 ^{b,B}	0.04

Conclusions

For cows synchronized with a Double Ovsynch protocol for first TAI:

- **Cows with low (≤ 2.50) BCS near AI had decreased fertility compared to cows with high (≥ 2.75) BCS (Exp. 1).**
- **Cows losing BCS in the first 3 weeks postpartum had decreased fertility (Exp. 2).**
- **Cows gaining BCS in the first 3 weeks postpartum had exceptional fertility (Exp. 2).**

Conclusions

- The proportion of cows that maintain or gain BCS may be affected by different management practices (Exp. 2).
- The decreased fertility in cows losing BCS can be partially explained by the reduction in embryo quality and increase in degenerate embryos 7 d after TAI in cows that lost more body weight during the first three weeks postpartum (Exp. 3).



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