



# Magnitude of the reduction in automatically scored BC from calving to nadir BCS affects the fertility of Holstein cows

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# Introduction

Adequate fertility has a significant role in the sustainability of dairy operations through impacts on milk production, genetic gain, and culling policies

Britt, 1985; De Vries, 2006



# Fertility and BCS

- The impact of inadequate body condition during early lactation in fertility has been explored
- Cows with extensive reductions in body condition score (BCS) between parturition and AI had extended anovulatory periods, decreased pregnancy per AI, and increased risk of pregnancy loss



Santos et al. 2010; Ribeiro et al., 2013, Pinedo et al., 2020

The interest in body condition scoring has increased in recent years, but only 36% of the US dairy farms have implemented BCS into their management practices

Kristensen et al., 2006; Bewley et al., 2010



Time consuming and  
subjective procedure

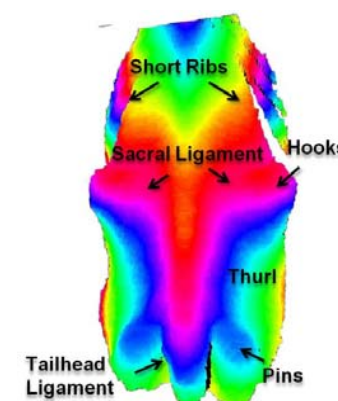
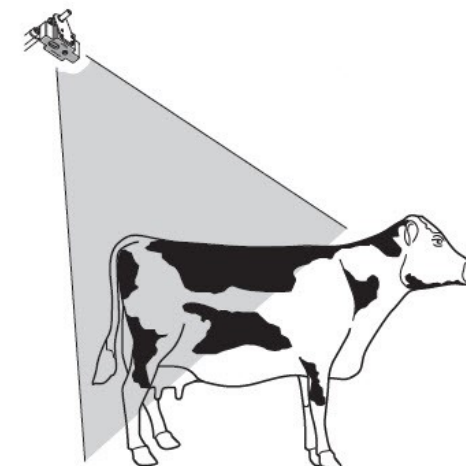


# Automated BCS through image technology

- Enables daily assessments of body energy reserves
- Allows for analysis of specific points of interest, such as nadir BCS
- Enables quick adjustments of management if necessary



Greater efficiency  
More objective and consistent  
High frequency data from large populations



# Objective

To evaluate the effect of the decrease in BCS from calving to nadir BCS before first artificial insemination (AI1) on pregnancy per AI1 (PAI1) in Holstein cows.





# Materials & Methods

**Design:** Retrospective observational study

**Data:** Daily automated BCS (2 DeLaval BCS cameras);  
6,100 lactations:

primiparous = 3,683; multiparous = 2,417

**When:** Cows calving between April 2019 and March 2021

**Where:** One commercial dairy operation in Colorado, USA

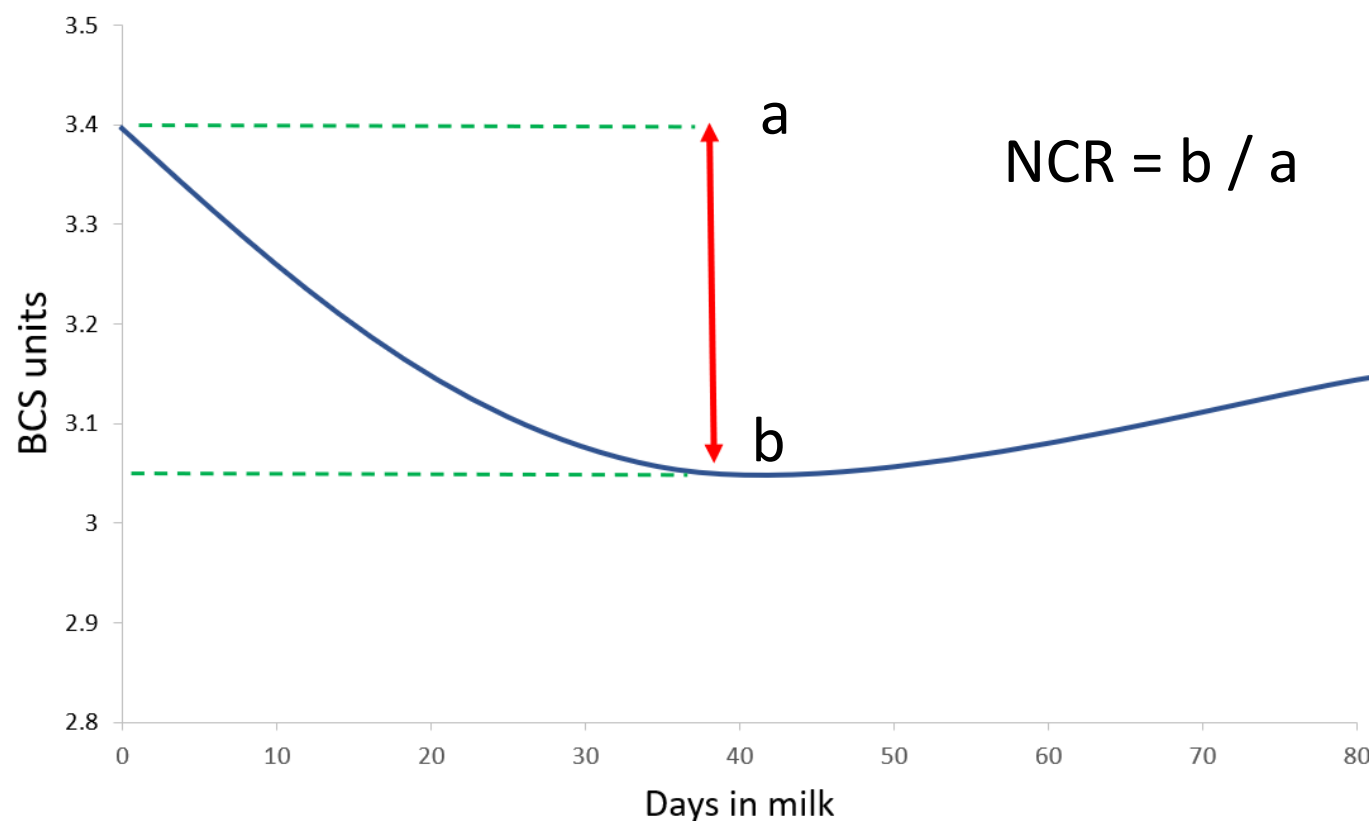


# BCS at calving and BCS at nadir were selected

Nadir Calving Ratio



$$\text{NCR} = \frac{\text{BCS at nadir}}{\text{BCS at calving}}$$





# Materials & Methods

- The Nadir Calving Ratio (NCR) is a representation of the BCS change from calving to nadir
- Greater BCS loss results in smaller values for NCR
- NCR values were categorized:
  - low ( $\leq$  lower quartile, large BCS decreases)
  - medium (interquartile range, moderate BCS decreases)
  - high ( $\geq$  upper quartile, small BCS decreases)



# Statistical analysis

- Logistic regression
- Covariables: calving season, occurrence of disease, and milk yield up to 60 DIM
- All the analyses were performed separately for primiparous and multiparous cows

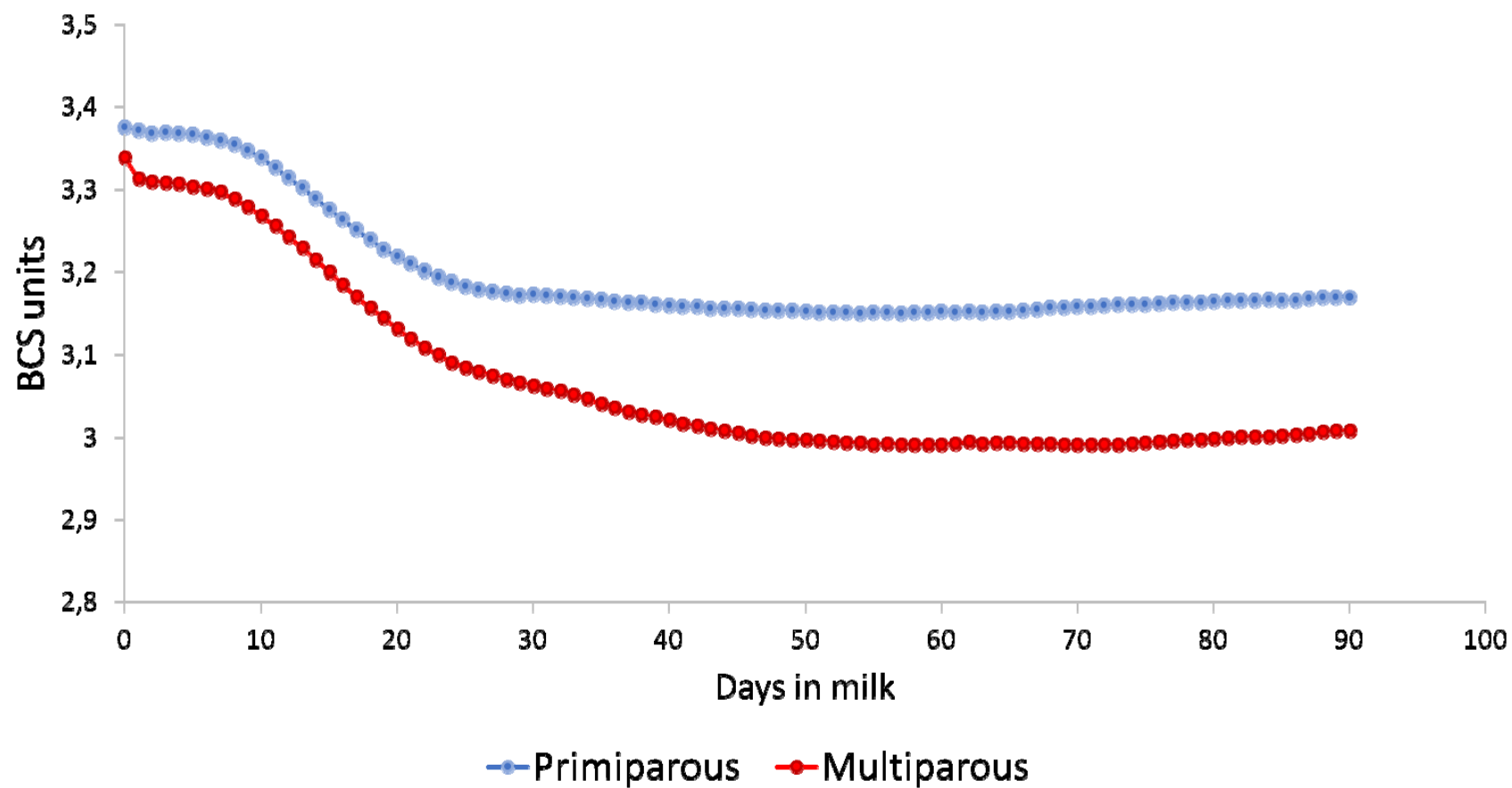


# Results: Summary statistics

	Primiparous	Multiparous
BCS at calving	3.38	3.34
BCS at nadir	3.15	2.99
BCS change	-0.22	-0.35
DIM at nadir (d)	51	59
NCR (median [range])	0.91 (0.61-1.00)	0.87 (0.53-1.00)
Milk yield (average 60 DIM; kg)	30.4	45.3



# Results: BCS dynamics by parity



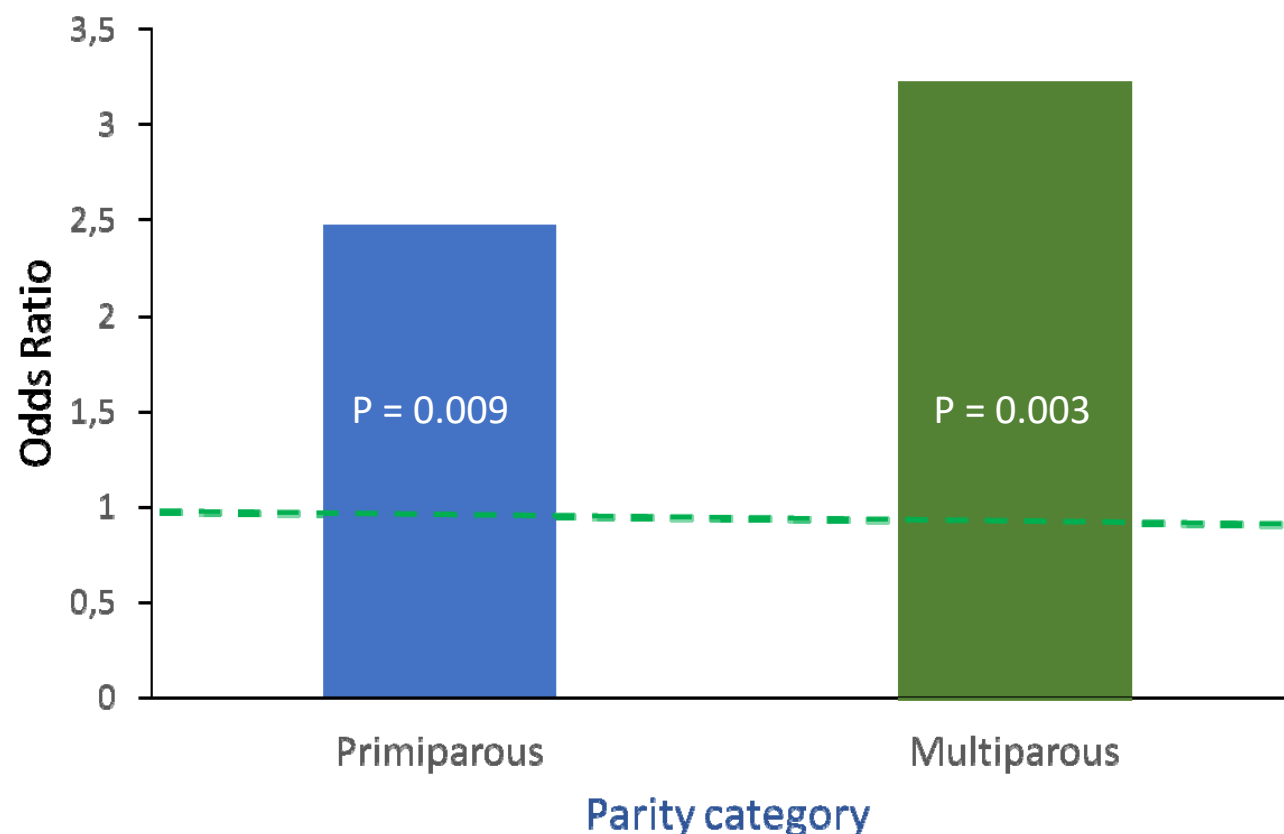
# Results: Pregnancy at first AI

	Primiparous	Multiparous
Mean (SD) DIM at AI1 (d)	83.3 (11.5)	63.4 (11.5)
Pregnancy per AI1 (%)	42.2	28.1

# Results:

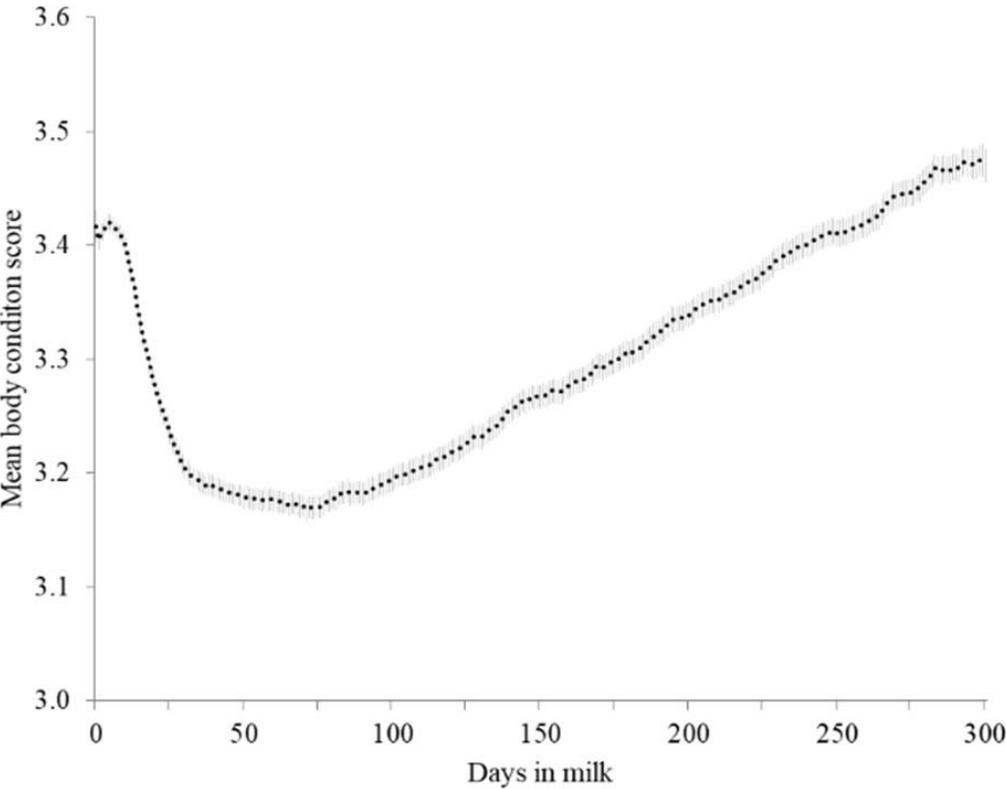
The odds of PAI1 increased by 2.47 (1.25-4.91) and by 3.22 (1.48-7.06) for each 0.5-unit increment in NCR in primiparous and multiparous cows

Odds of PAI1 for each 0.5-unit increment in NCR



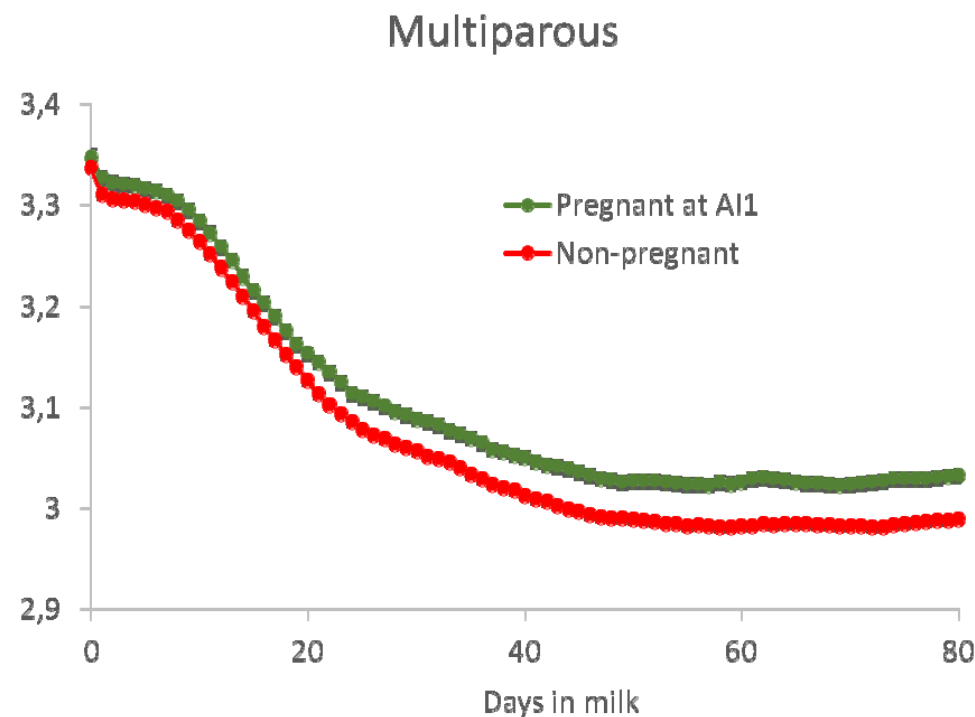
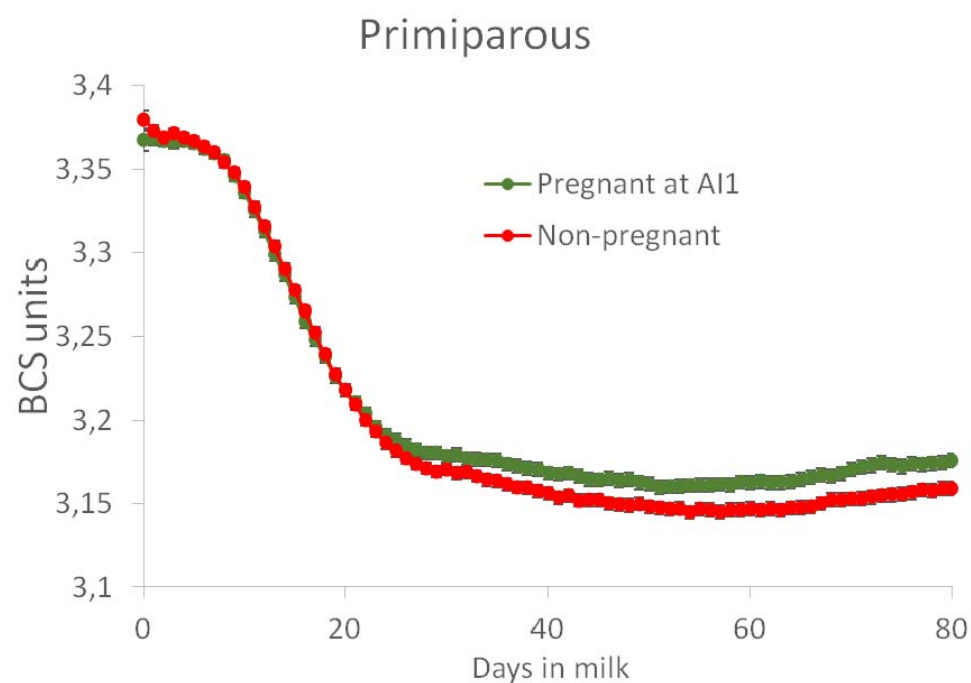


**Discussion:** This study BCS at calving and BCS at nadir are similar to those previously reported (Truman et al., 2022)



	Primiparous	Multiparous
BCS at calving	3.40	3.40
BCS at nadir	3.26	3.10
DIM at nadir (d)	51	59

**Discussion:** The dynamics of BCS are different for cows that conceive or remain open at AI1



Pinedo et al., 2021

# Conclusions

The magnitude of the drop of BCS at calving and nadir BCS had a significant impact on pregnancy at first artificial insemination.

The larger the drop in BCS, the less likely P/AI1. The effects were larger for multiparous than primiparous cows.

Automatic BCS is a useful tool to monitor and manage energy balance.

Potential for fertility management deserves further exploration.



Individual cow/group onset of breeding window based on BCS profiles.





Thank you