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Effect of Timing of Prepartum Vaccination Relative to Pen Change of Dairy Cows on Lying Time and Serum Glucose, Non-esterified Fatty Acids, and Calcium at Calving

Take-home Points

- Vaccination of cows 7 d prior pen change improved LT for the 3 d thereafter, increased serum glucose concentrations and reduced the proportion of postpartum cows with hypocalcemia at calving.
- The vaccination of cows 7 d prior pen change would benefit common prepartum changes in metabolism.

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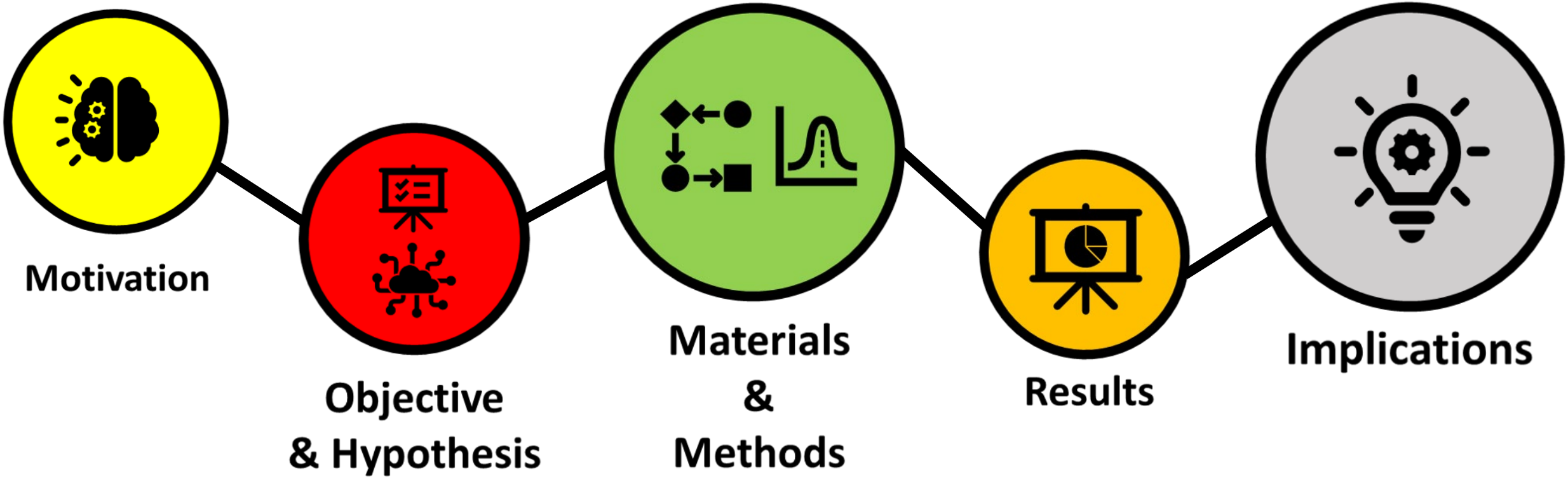
Motivation
Objective & Hypothesis
Materials & Methods
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Motivation

Traditional Approach

Pen Change + Vaccination

Far-off → **Prepartum**

Pen Change

- ↓ DMI and feeding behavior
- ↓ Cellular immune response
- ↓ LT
- ↑ CV of LT

+

Vaccination

- ↑ Metabolic rate
- ↑ Metabolic cost
- ↓ Appetite
- ↓ Feed intake

Pen change and vaccination may worsen the ability of animals to maintain homeostasis because of the negative effect on LT, eating behavior, and DMI

LT: Lying time; CV of LT: Coefficient of variation of lying time; DMI: Dry matter intake; NEFA: Non-esterified fatty acids

Objective & Hypothesis

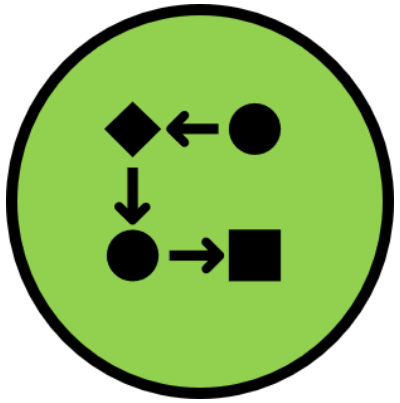
Objective

- To assess the effects of timing of prepartum vaccination relative to pen change of pregnant Holstein dairy cows on lying time (LT), energy status (serum glucose, and nonesterified fatty acids [NEFA]), and serum calcium at calving.

Hypothesis

- We hypothesized that dams vaccinated 7 days prior to prepartum pen change will increase their lying time, serum glucose, decrease serum NEFA concentrations and improve calcium status at parturition compared to dams vaccinated at the time of pen change

Materials and Methods



Experimental Design

Statistical Analysis

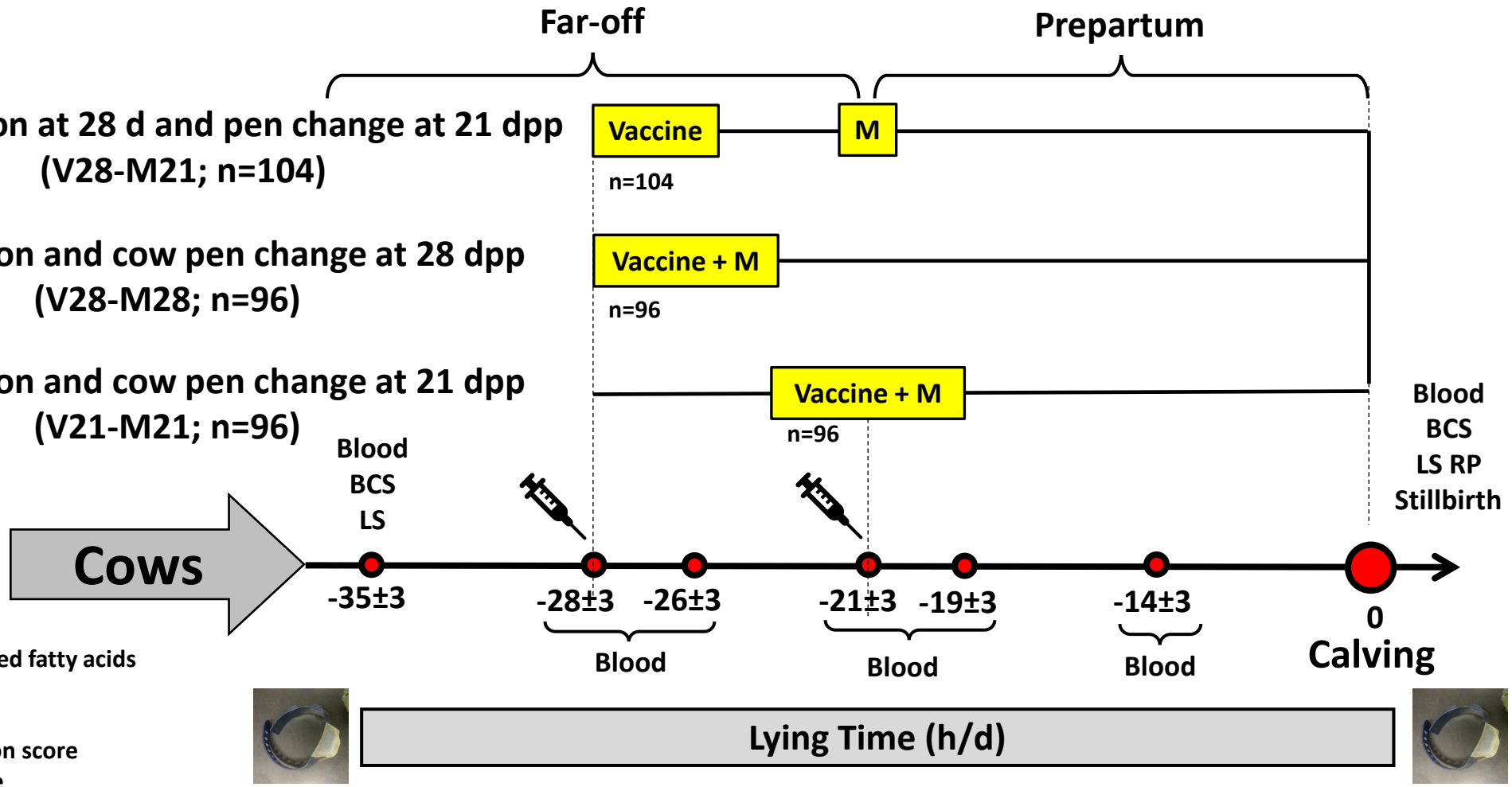
Experimental Design

Pregnant Holstein cows (n=296) from one dairy herd were randomly allocated into 1 of 3 treatment groups at 35±3 d prior to anticipated parturition (dpp)

1) Vaccination at 28 d and pen change at 21 dpp (V28-M21; n=104)

2) Vaccination and cow pen change at 28 dpp (V28-M28; n=96)

3) Vaccination and cow pen change at 21 dpp (V21-M21; n=96)



Blood Sample:
NEFA = Non-esterified fatty acids
Glucose
Calcium
BCS = Body condition score
LS = Lameness score

Statistical Analysis

- **Generalized Linear Mixed Model (GLIMMIX procedure of SAS)**
  - Effect of vaccination and pen change on lying time (LT), and serum NEFA for the 7-d following the procedures
  - Effect of vaccination and pen change on serum calcium and glucose concentrations at calving
- **Accounting for the effects of:**
  - Parity
  - BCS
  - Lameness Score
  - Time (repeated measures)
  - Cohort as a random effect
- **Model selection: Backwards stepwise base on smallest AIC**
- **Multiple comparisons were adjusted using Tukey-Kramer**
- **Statistical significance at $P<0.05$**

Results

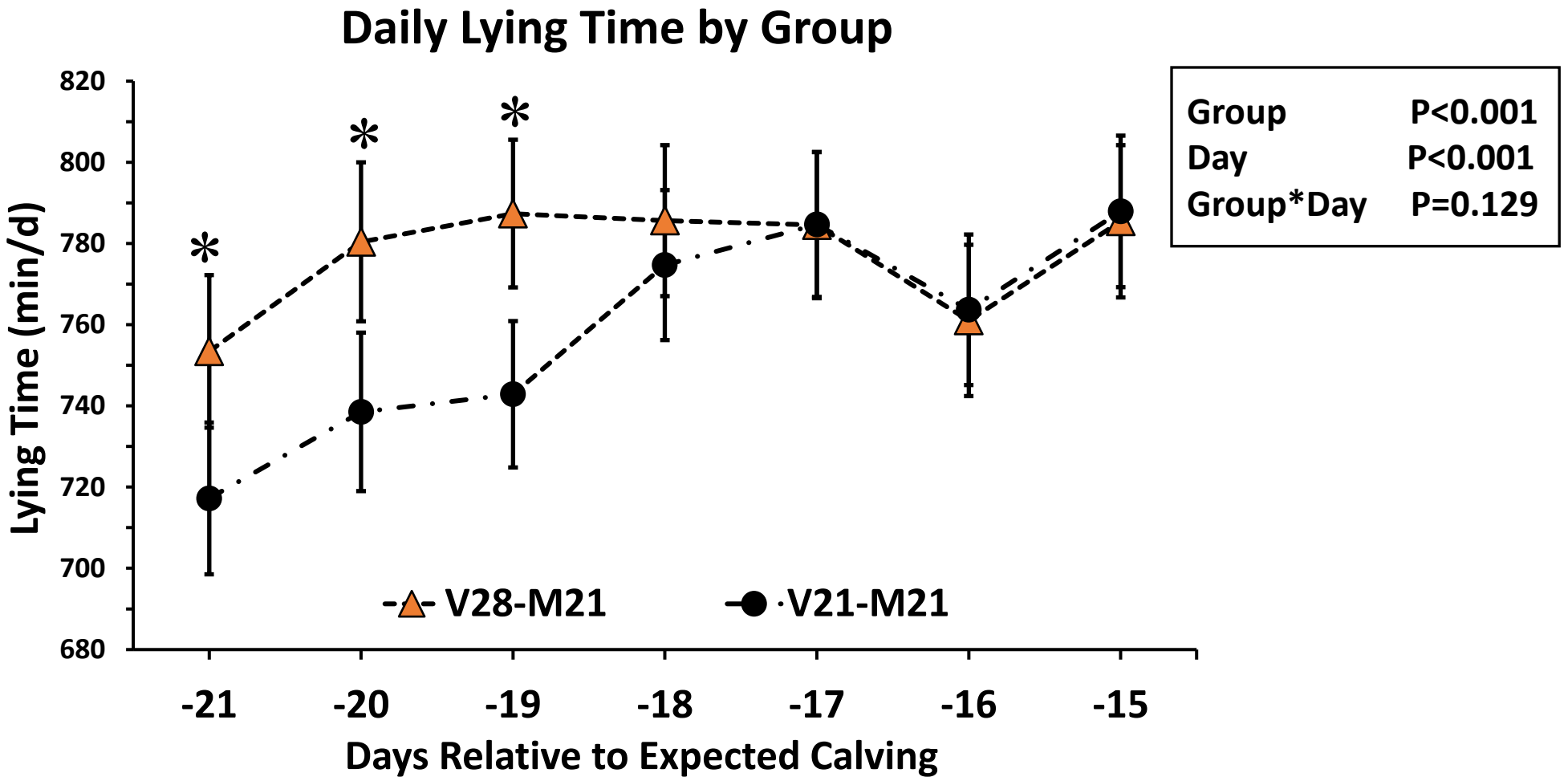
Lying Time

NEFA

Hypocalcemia and Glucose

Lying Time

- Cow movement with vaccination reduced LT (P=0.0003) by 36 min/d for the first 3 d thereafter compared to cow movement alone



NEFA

- V21-M21 cows had higher concentrations of NEFA at **19** and **14** dpp compared to V28-M28 or V28-M21 cows while no differences among groups were observed at calving.

Items[1]	Groups			*P*-value
	V28-M21	V28-M28	V21-M21	
NEFA at 21±3 dpp, µEq/L[1]	138.80±15.2	121.54±15.3	129.39±15.2	0.29
NEFA at 19±3 dpp, µEq/L[1]	109.64±15.1[b]	102.55±15.3[b]	170.39±15.1[a]	<0.0001
NEFA at 14±3 dpp, µEq/L[1]	130.07±14.3[b]	141.92±14.2[b]	161.79±14.3[a]	0.01
NEFA at Calving, µEq/L[1]	858.96±68.7	922.71±69.77	902.79±69.22	0.43

[a,b]Values with different superscript letters within a row differ significantly at P < 0.05.

[1]Prepartum serum NEFA concentration expressed as µEq/L was assessed at 21±3, 19±3, and 14±3 days relative to expected calving and at calving.

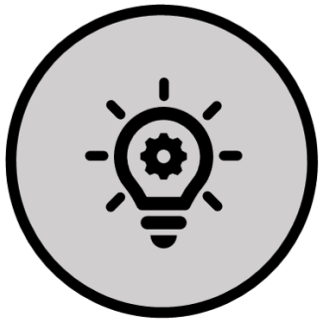
Hypocalcemia and Glucose

- **Vaccination of cows 7 d prior pen change reduced the proportion of postpartum cows with hypocalcemia and increased serum glucose concentrations at calving compared with V21-M21 cows but did not differ from V28-M28 cows.**

Items	Groups			*P*-value
	V28-M21	V28-M28	V21-M21	
Hypocalcemia < 8 mg/dL, %[1]	18.7[b]	24.8[ab]	37.3[a]	0.004
Glucose at Calving, mg/dL[2]	114.47±6.4[a]	107.20±6.6[ab]	101.63±6.5[b]	0.04

[a,b]Values with different superscript letters within a row differ significantly at P < 0.05.
[1]The proportion (%) of cows with hypocalcemia (< 8 mg/dL) within 1 h after parturition using total serum calcium concentration (Reinhardt et al., 2011).
[2]Prepartum serum glucose concentration expressed as mg/dL was assessed at calving.

Implications



- These findings suggest that by uncoupling the stressors of pen change and vaccination, cows would benefit from common prepartum changes in metabolism such as improving serum glucose and calcium concentrations at calving
- The vaccination of cows 7 d prior pen change could be part of an overall strategy in combination with other management practices to reduce serum NEFA concentrations prior to parturition

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Thank you!!!