

Calving synchronization and strategy to prevent hypocalcemia in dairy cows

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Proposal

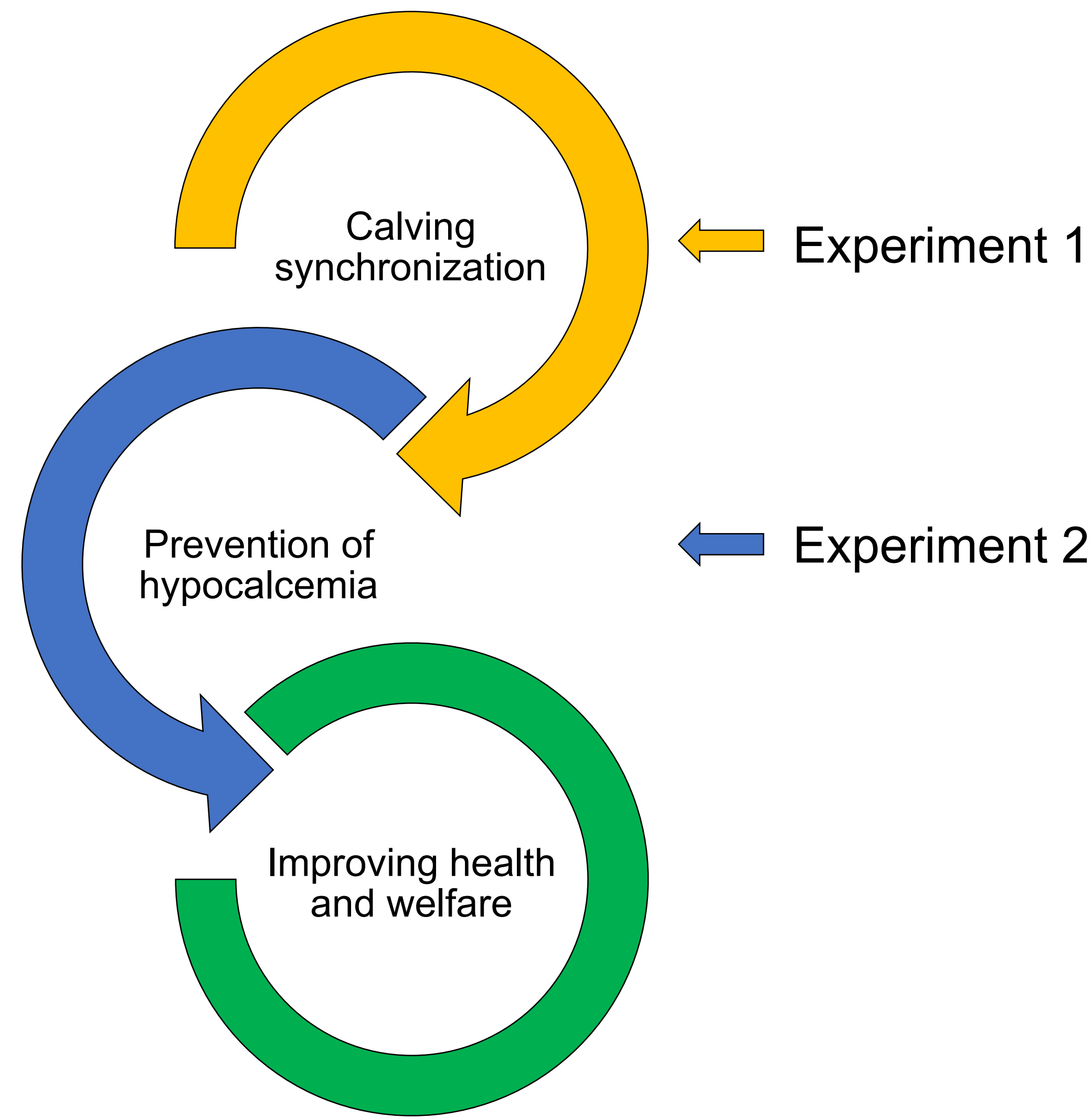


Figure 1 – The proposal submitted to DIH had two experiments. Experiment 1 aimed to develop a practical program for synchronized calving to optimize cow and calf health and productivity. Experiment 2 aimed to prevent subclinical hypocalcemia during postpartum by prepartum treatment with EGTA.

Experiment 1

Introduction

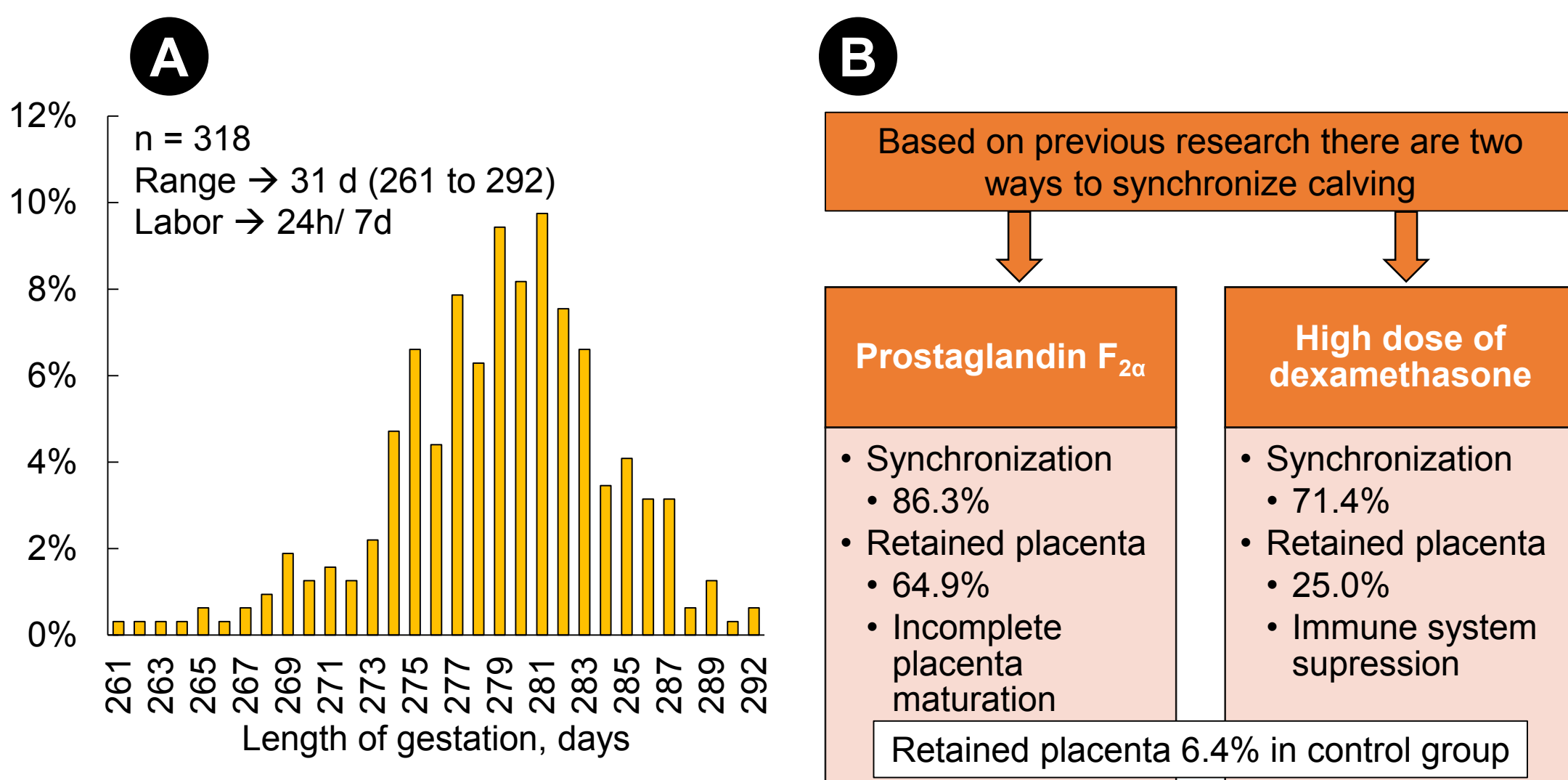
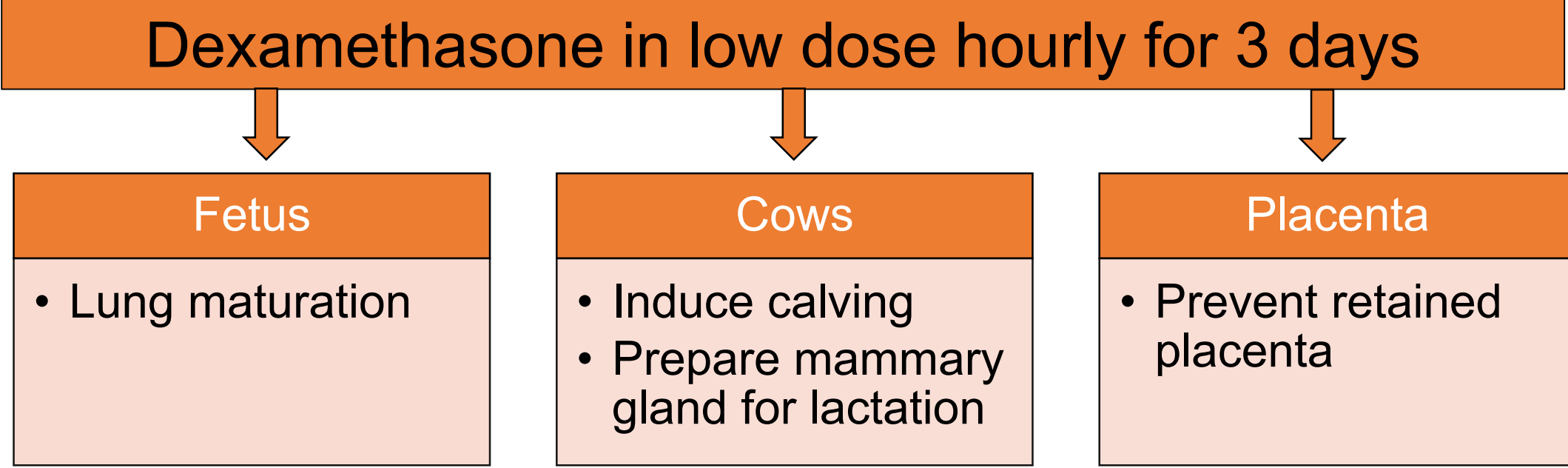


Figure 2 – A) Distribution of calving according by gestation length of dairy cows at USDA DFRC. B) Strategies used previously to synchronize calving and a summary of the main results (Lewing et al., 1985; Bo et al., 1992; Hartmann et al. 2013; Salar et al. 2019).

Hypothetical model



Material and methods

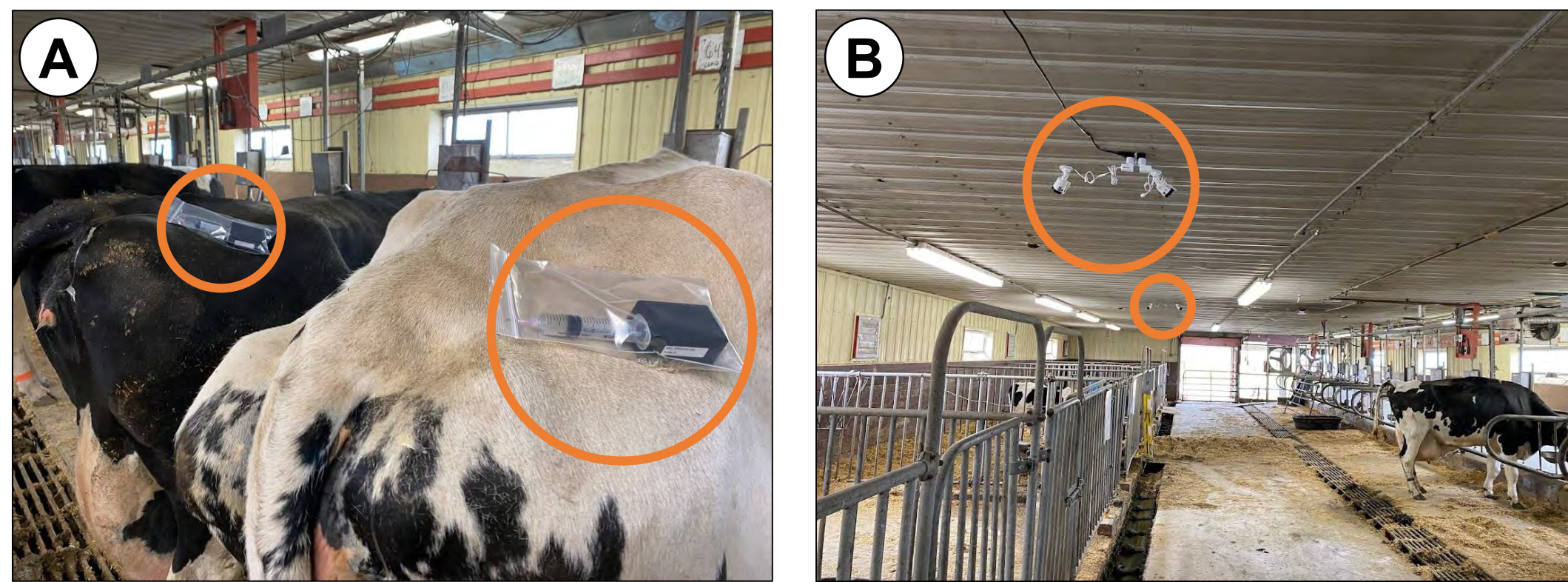


Figure 3 – A) Drug delivery pump built in the Wiltbank and Hernandez Lab to deliver dexamethasone during the experiment using a small catheter placed in the vagina. B) Cameras installed in the barn to be precise with the time of calving and placental release in individual cows.

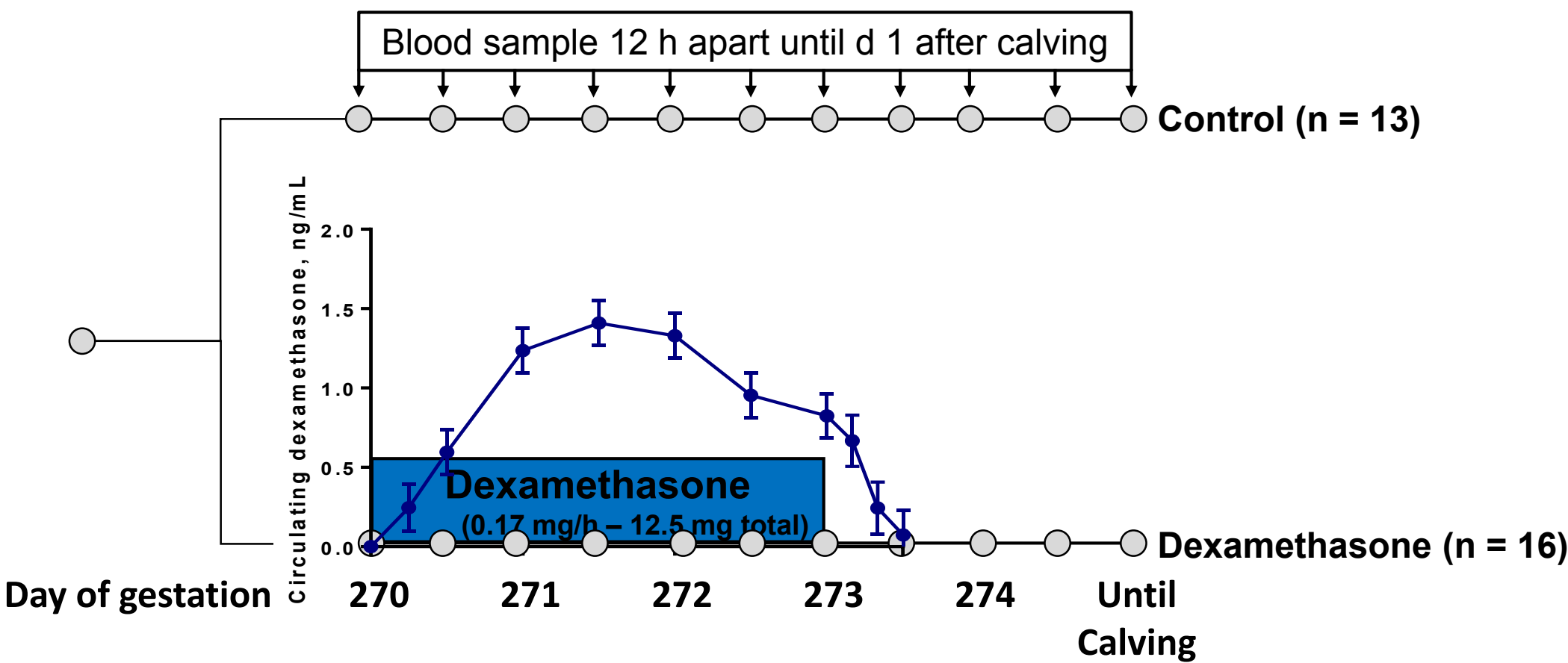


Figure 4 – Experimental design of experiment 1. Dairy cows at 270 d of gestation were assigned randomly to two treatments: Control (n = 13), cows did not receive any treatment; Dexamethasone (n = 16), cows received hourly, by a drug delivery pump, a total of 12.5 mg of dexamethasone during 72 h. Blood was sampled 12 h apart beginning immediately before start of treatment until one day after calving. A graph is shown in blue representing circulating dexamethasone concentration during the treatment period and by 12 h after finishing treatment.

- Blood sampled → Progesterone and metabolites PGF_{2α} (PGFM)
- Calves were weighed
- Colostrum were evaluated (yield and BRIX)
- Data were analyzed by Glimmix procedure of SAS (Version 9.4)

Results

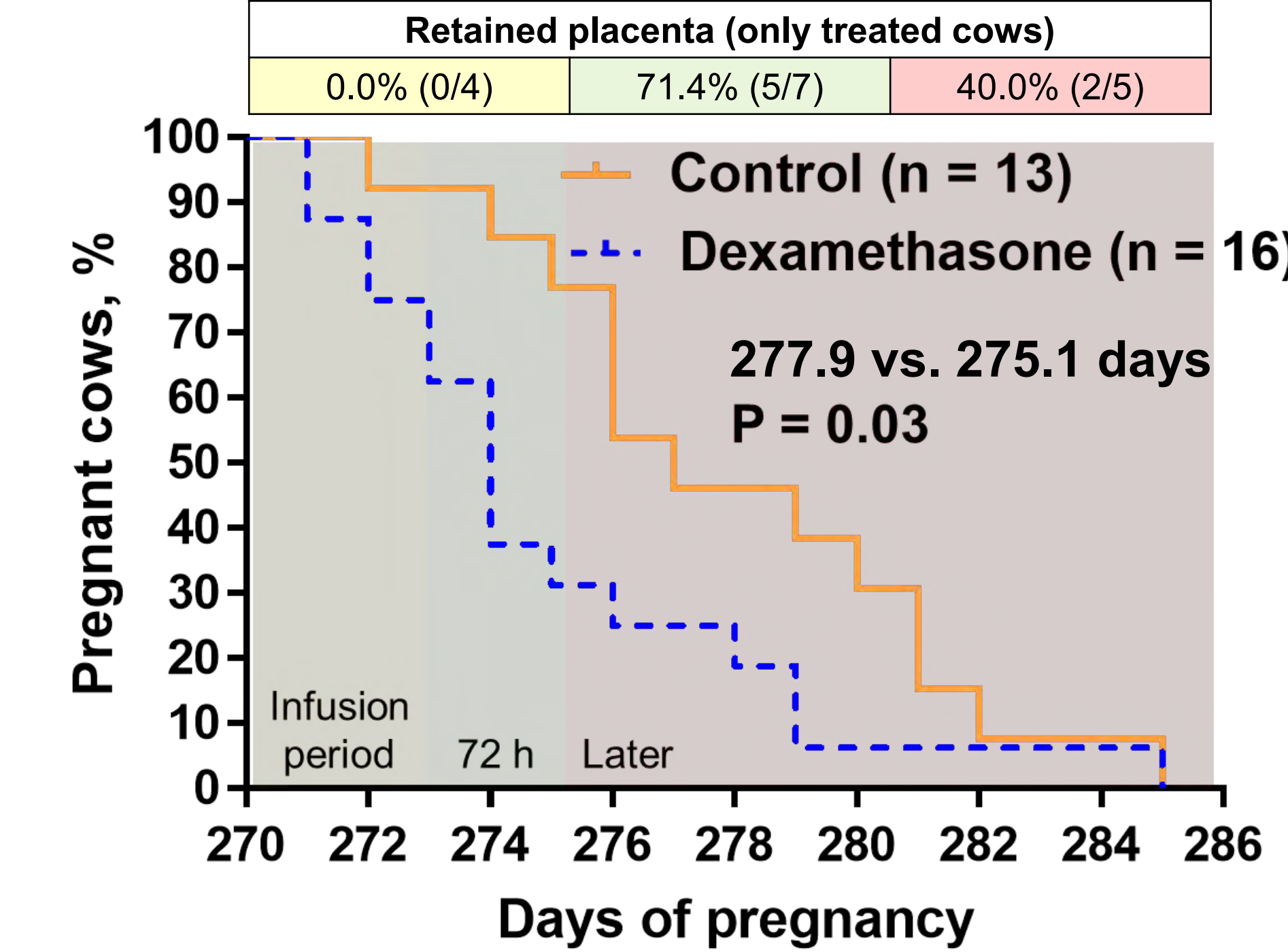


Figure 6 – Kaplan-Meier survival curves comparing gestation lengths between treatments.

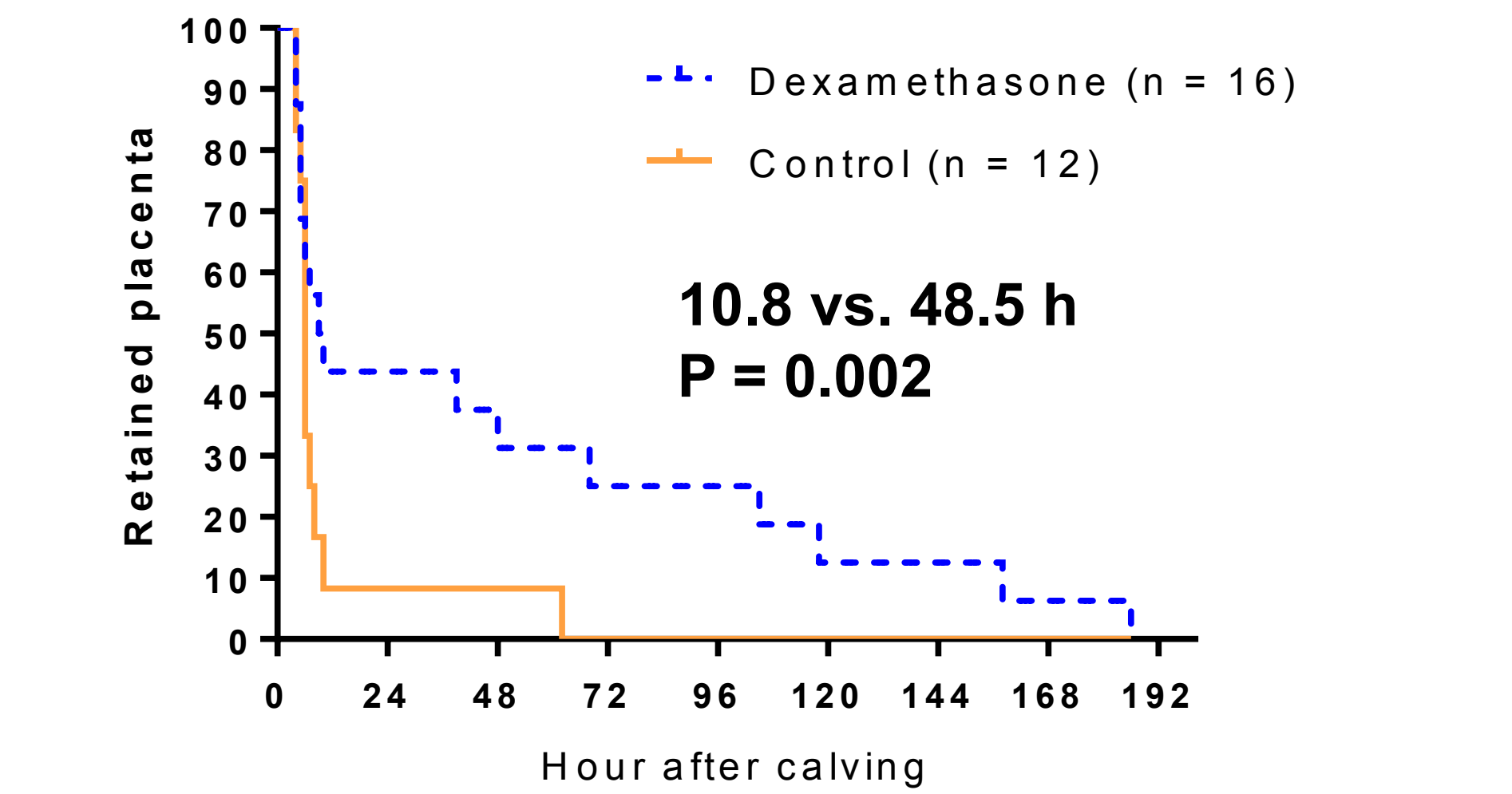


Figure 7 – Kaplan-Meier survival curves comparing time until placental release between treatments.

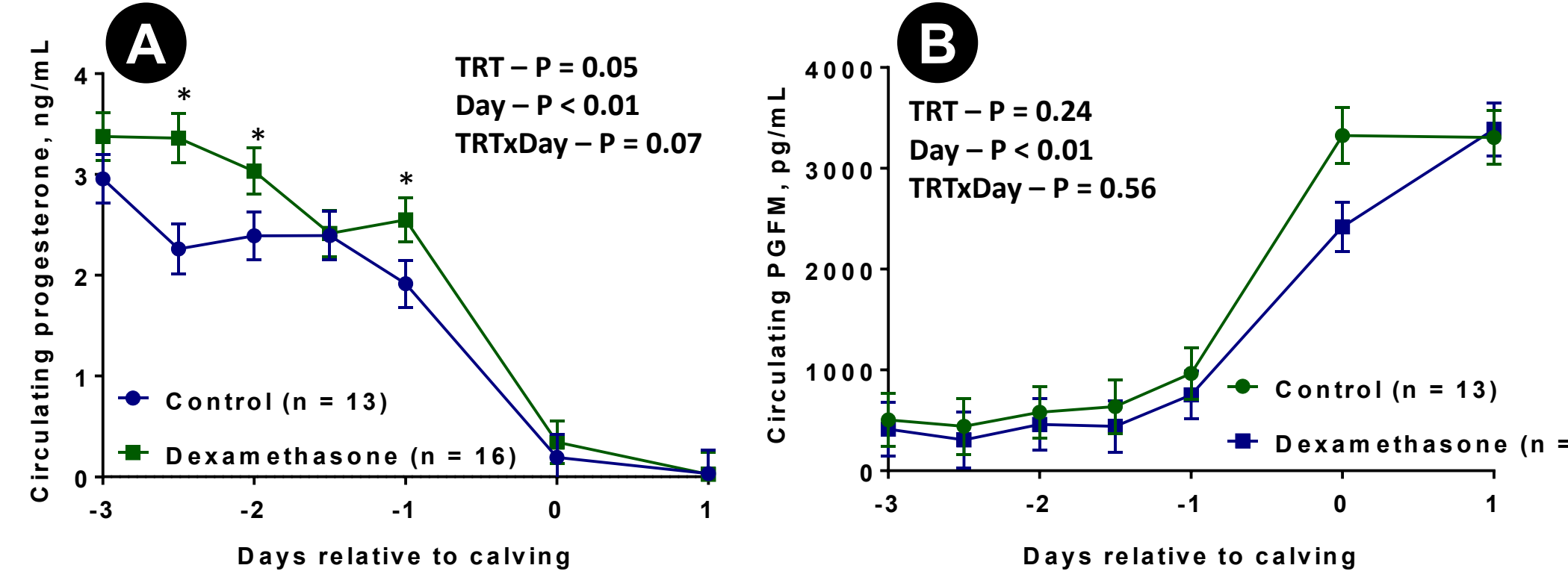


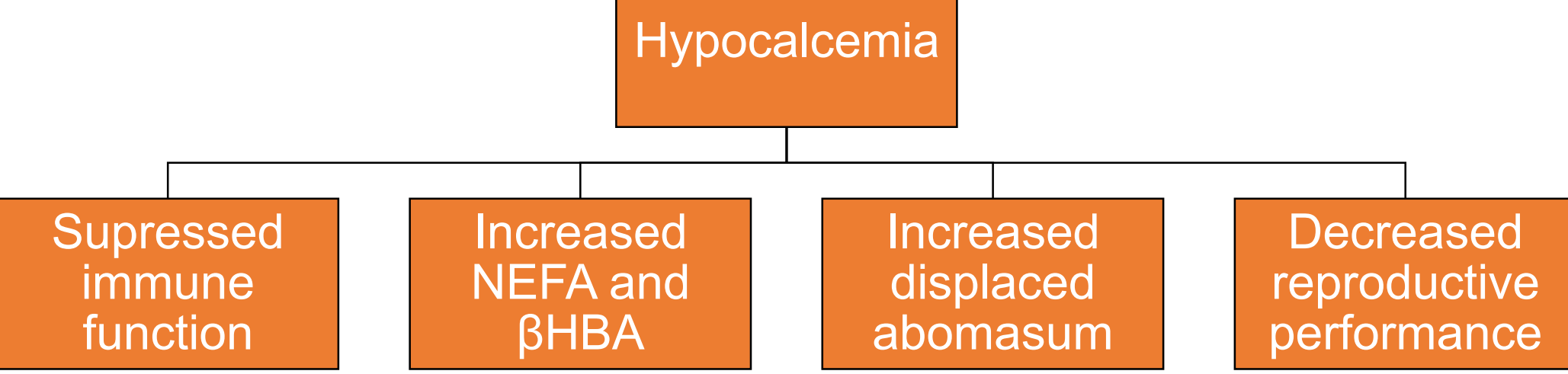
Figure 8 – The concentration of circulating progesterone (A) and PGFM (B) according to the treatments and days relative to calving.

Table 1 – Calf weight at birth, colostrum yield and quality (BRIX), and calf mortality rate according to treatments

	Control	Dexamethasone	P
Colostrum yield, kg	7.5 ± 1.4	7.3 ± 1.3	0.92
Colostrum BRIX	25.3 ± 1.5	22.0 ± 1.4	0.13
Calf weight at birth, kg	41.4 ± 1.7	38.9 ± 2.0	0.34
Calf mortality rate, %	0% (0/13)	0% (0/16)	-

Experiment 2

Introduction



Hypothetical model

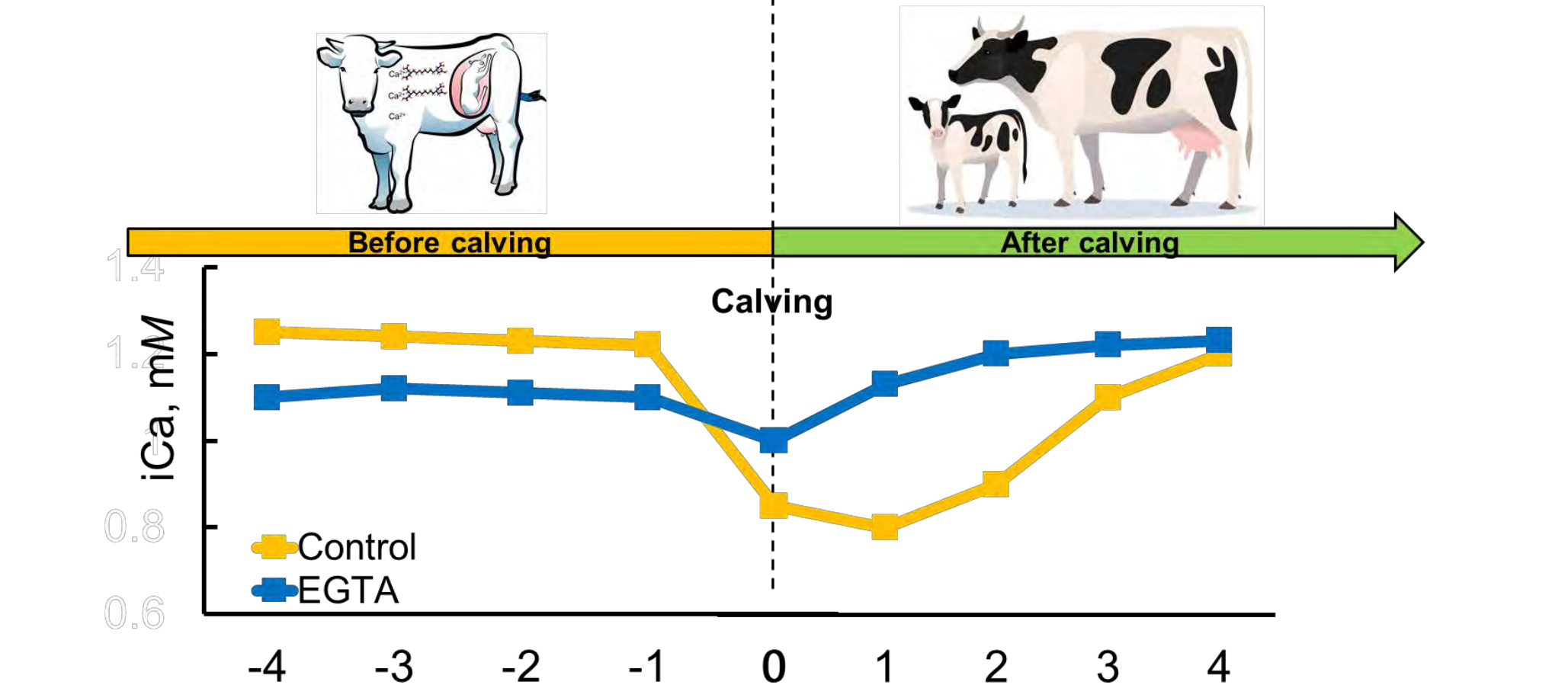


Figure 9 – Hypothesis - inducing subclinical hypocalcemia using EGTA infusion before calving will stimulate calcium activation mechanisms before calving and thereby improve calcium homeostasis after calving.

Material and methods

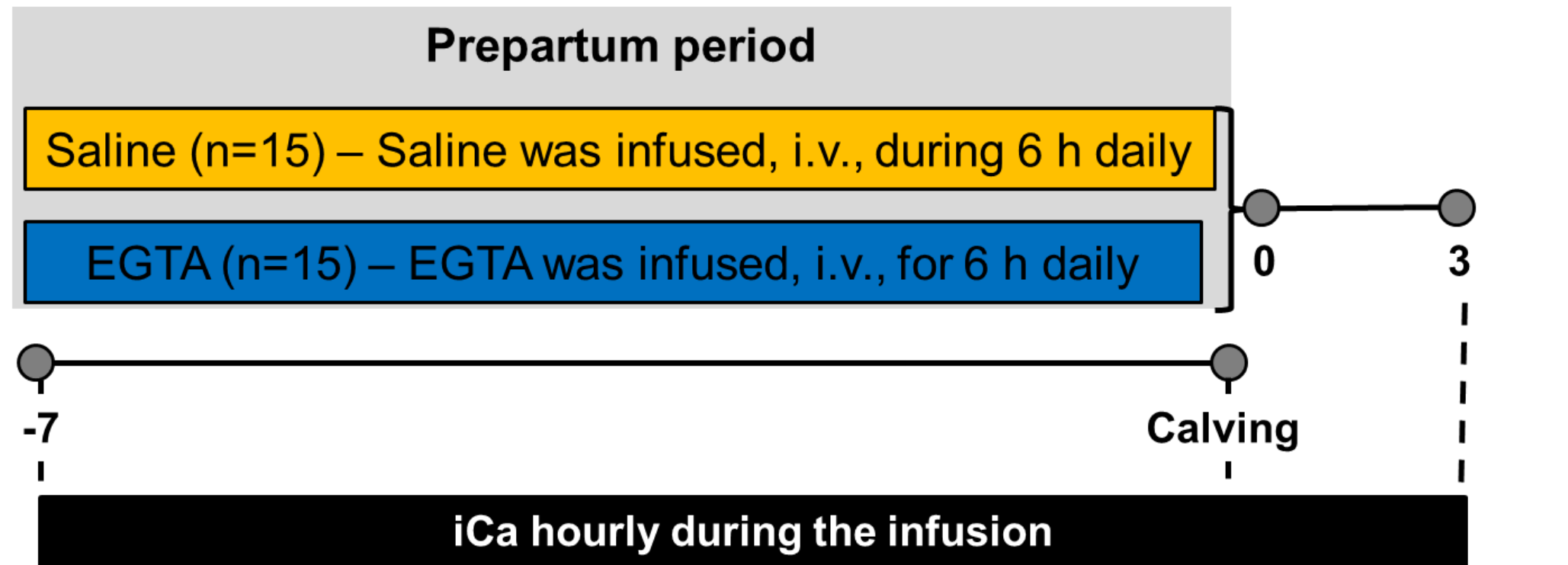


Figure 10 – Experimental design of experiment 2. Cows were treated daily for 6 h from d 273 of gestation (7 d before the expected day of calving) until calving. Circulating iCa concentrations were evaluated hourly during the infusion and one hour later daily. Circulating iCa concentrations were also evaluated at calving (d 0), 0.5, 1, 2, and 3 d after calving.

Results

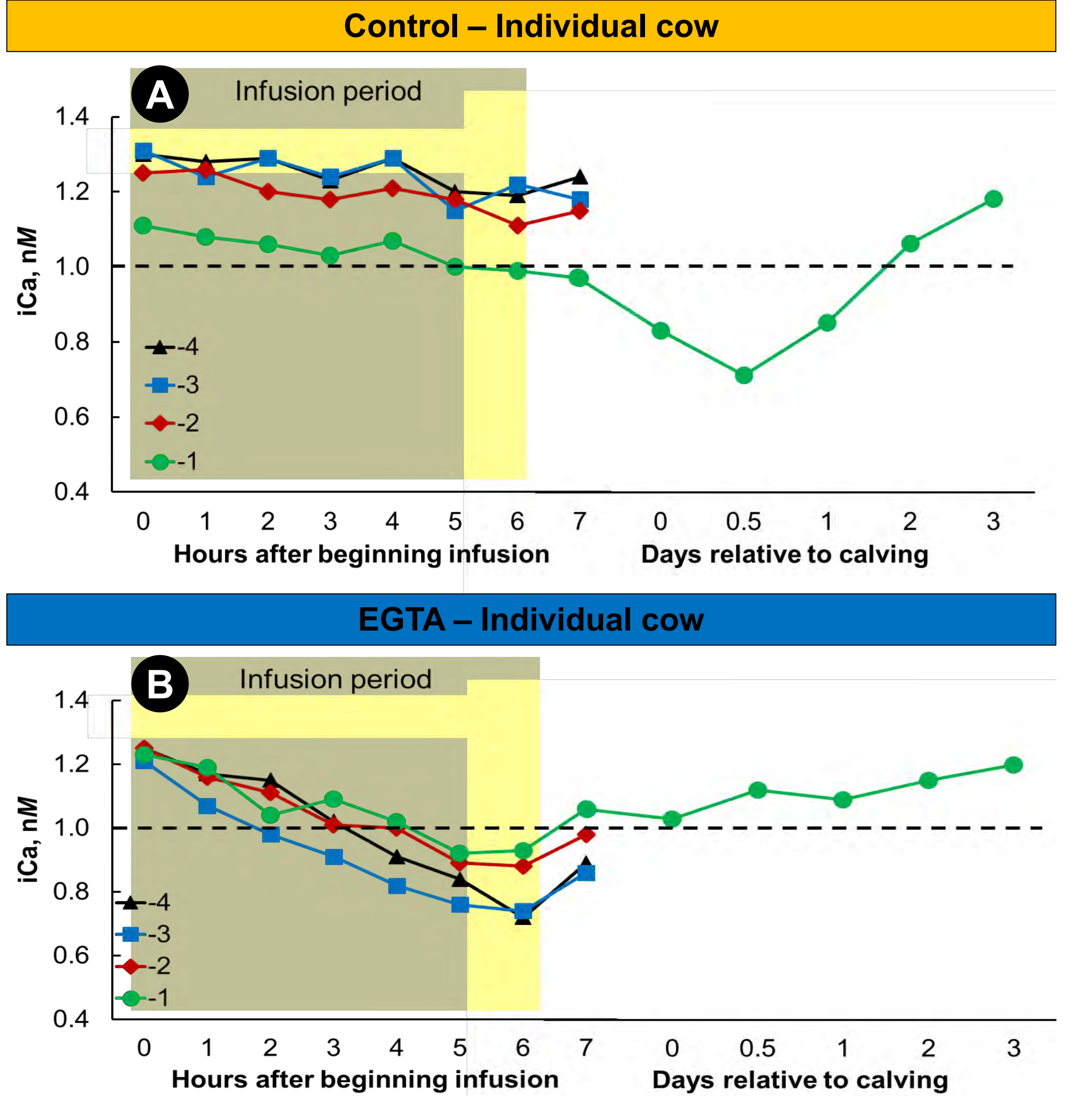


Figure 11 – Individual profile of circulating iCa concentrations during the infusion on 4d, 3d, 2d, and 1d before calving (see legend), and after calving for a control (A) and an EGTA-treated cow (B).

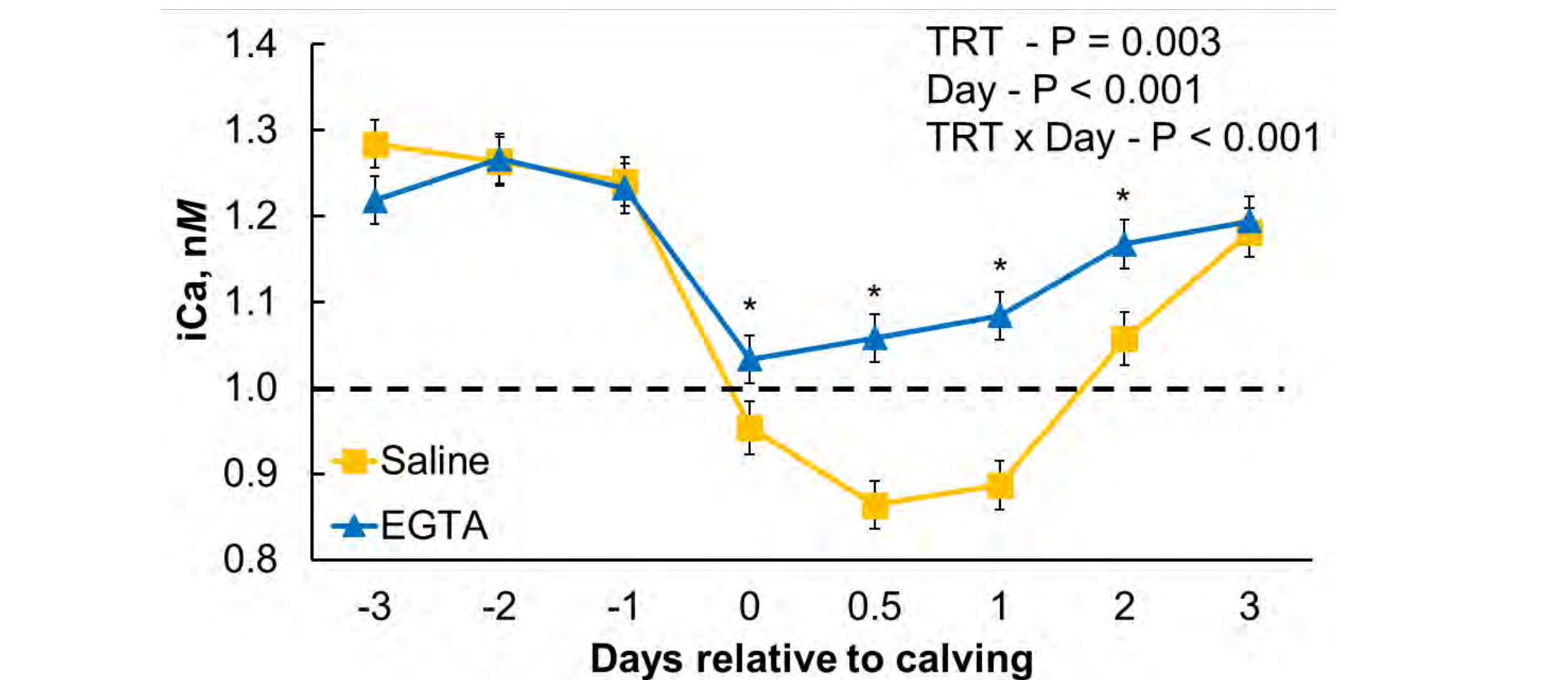
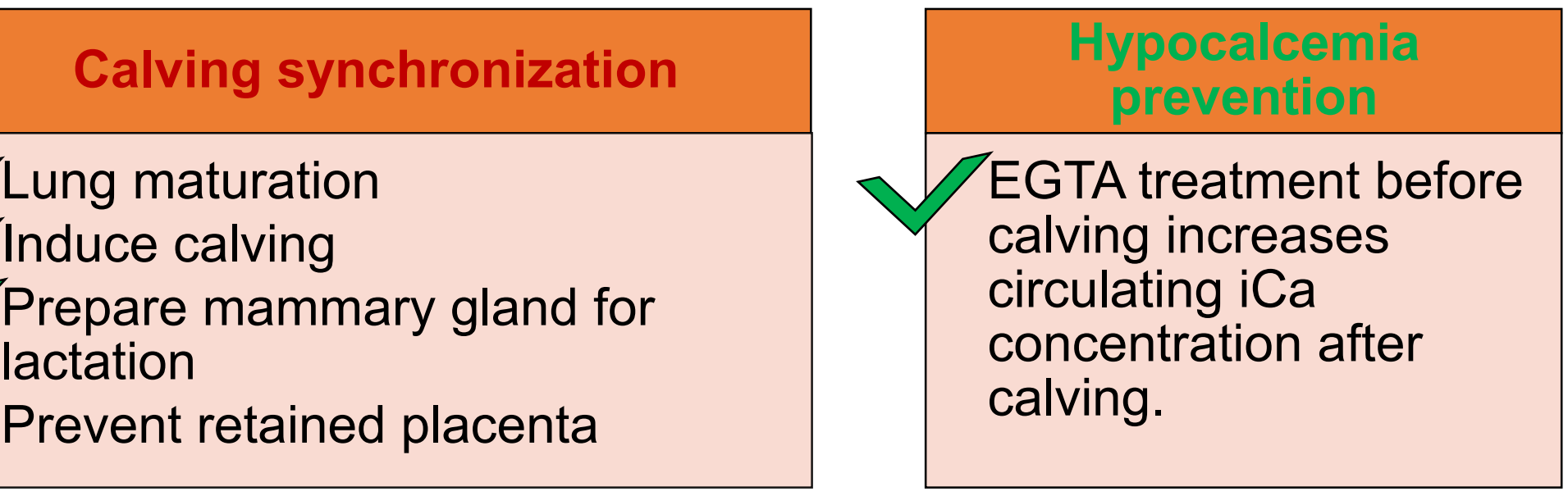


Figure 12 – Circulating iCa concentrations according to treatment and days relative to calving.

Conclusions



Endocrine profile at calving Research in progress

We are continuing the objective of reducing retained placenta after inducing calving by investigating the precise sequence of hormonal events during the normal calving process. We are also developing a new method for inducing and synchronizing calving that more closely mimics the normal events of calving without increasing the incidence of retained placenta.

- Blood samples
 - From d -28 to d 3 (d 0 = calving) → once daily
 - From d -8 to d 0 → hourly during 7 h period every day
- Hormone assays (Partial results)
 - Progesterone
 - PGFM
 - PGF_{2α} (in progress)
 - Estradiol (in progress)
 - Testosterone (in progress)

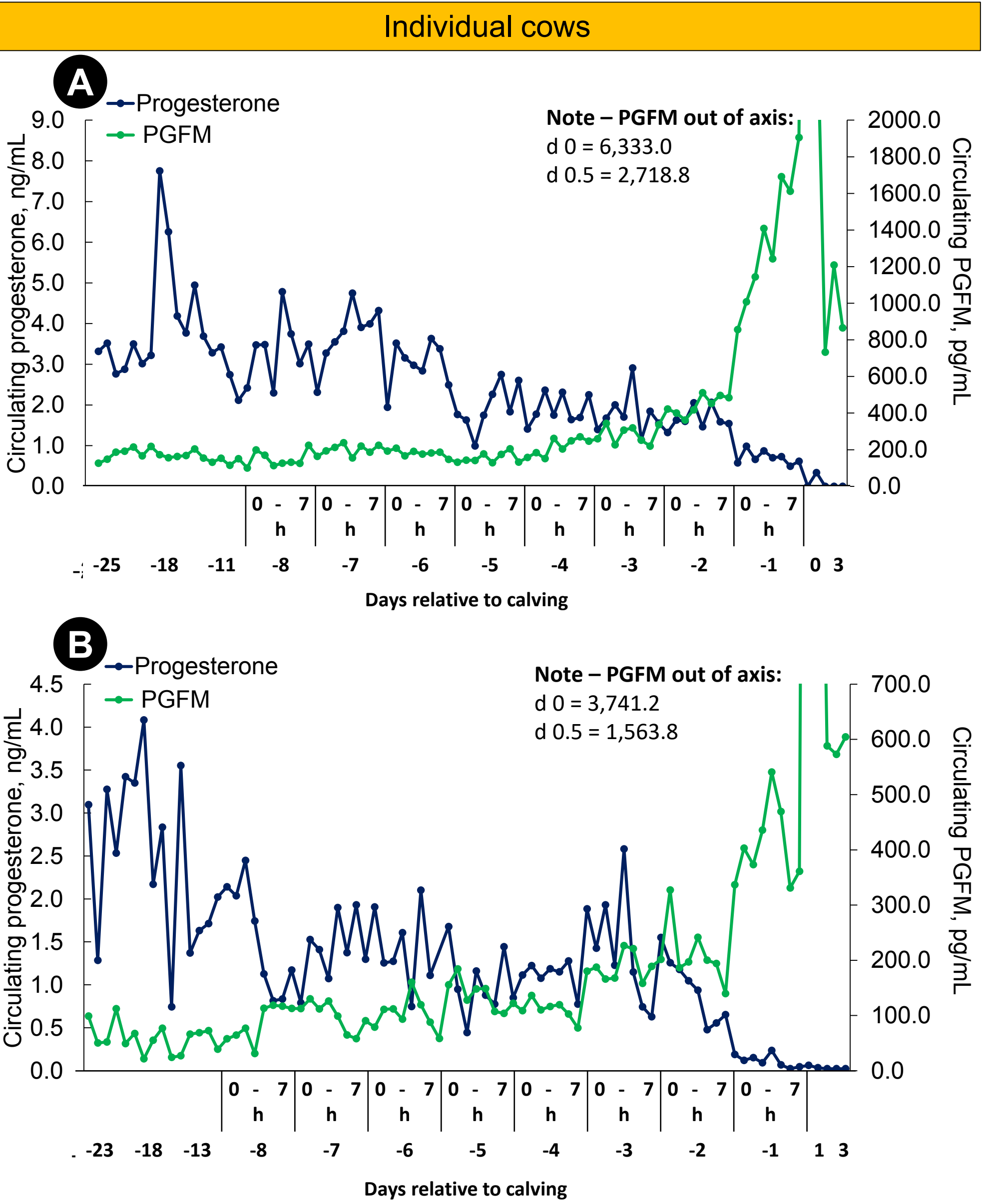


Figure 13 – Individual profile of the concentration of circulating progesterone and PGFM according to days relative to calving from two cows (6420 [A] and 6227 [B]).

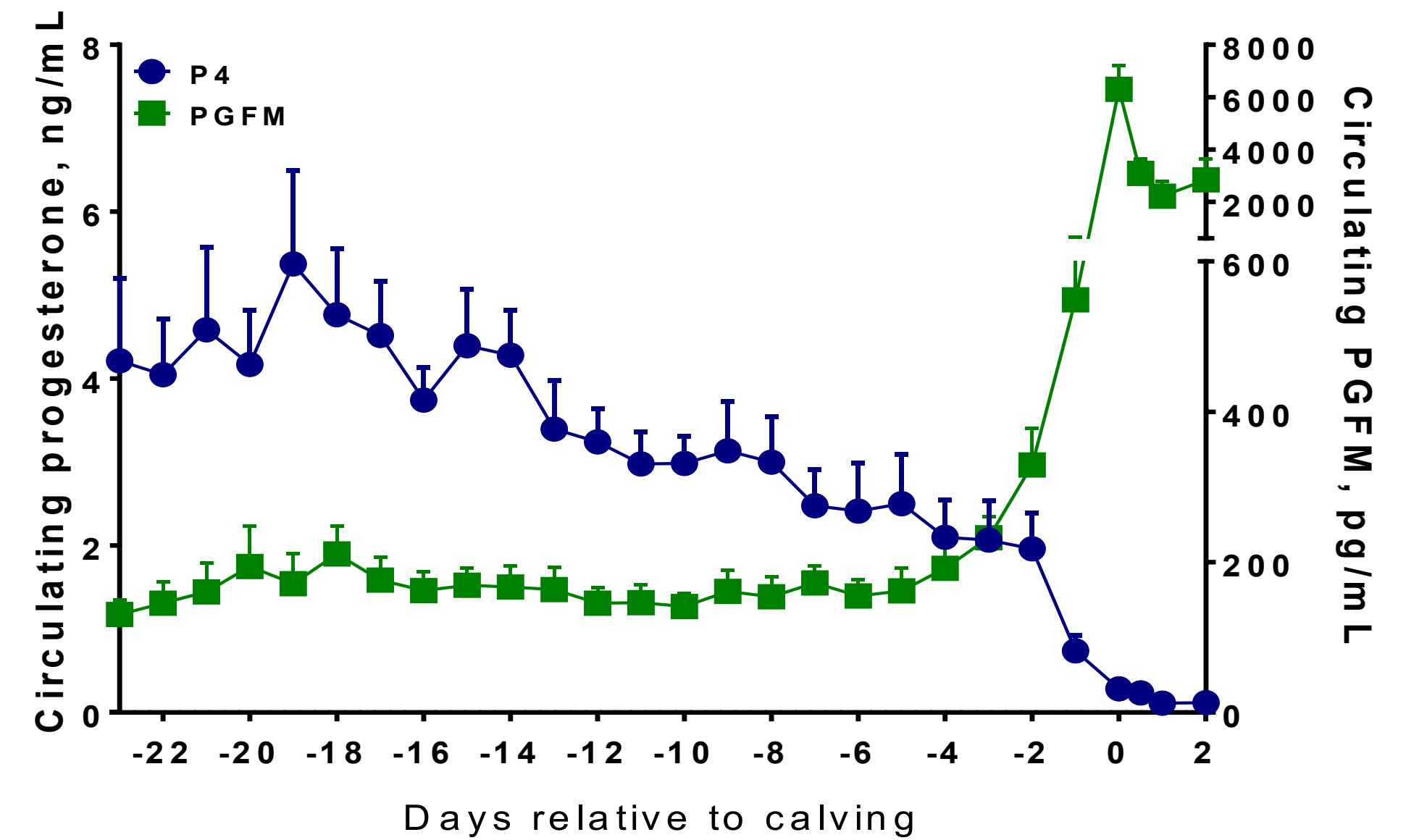


Figure 14 – The concentration of circulating progesterone (P4) and PGFM according to the treatments and days relative to calving.

Acknowledgements

