EVALUATION OF EQUINE CHORIONIC GONADOTROPHIN TREATMENT OF POST-PARTUM NZ DAIRY COWS

Objective

To evaluate the reproductive outcomes of NZ dairy cows treated with equine chorionic gonadotrophin (eCG) on day 6 after calving.

Background

A significant problem identified in the New Zealand dairy industry is the decline in reproductive efficiency[1,2], with the percentage of post-partum anoestrous cows increasing over the last decades[3]. For a cow to calve on the same (or earlier) calendar date in the subsequent lactation, there are 82 days after parturition during which to conceive, which includes time required for uterine involution and resumption of ovarian activity and regular oestrus cyclicity. The resumption of normal ovarian activity after parturition is one of the key factors for maintaining reproductive efficiency. Post-partum anoestrus in dairy cows is not due to the absence of a dominant follicle, but rather the failure of the dominant follicle to ovulate[5]. Although a new follicular wave commences about 2-5 days after parturition[6] and may reach a large size by day ten[7], the fate of the dominant follicle is uncertain. It may experience ovulation, cystic degeneration or atresia[1,2]. Administration of eCG on day 6 post-partum can enhance follicular growth and ovulation in the dominant follicle of the first follicular wave, and reduce the interval from calving to the first ovulation[4]. In a 2013 dairy cow study eCG decreased the number of days to first service and increased the first service conception rate[8].

Advancing regular ovulation cycles post-partum by administering eCG on day 6 post-partum could increase the likelihood of conception within the narrow time frame thereby improving reproductive efficiency in NZ dairy cows.

Materials and methods

The study was undertaken in 15 New Zealand dairy herds. The study enrolled 9,808 mixed-age cows at 6 days post-calving.

Cows were body condition scored (BCS) within 3 weeks before to 5 days after calving, and enrolled into the study on Day 6 after calving. On each farm, cows which had calved on Tuesday, Thursday and Saturday were allocated to treatment Group 1, (eCG) and cows which had calved on Wednesday, Friday and Sunday were allocated to treatment Group 2 (Control). Cows in Group 1 received 400IU of eCG (2mL) and cows in Group 2 received 2mL of sterile water. Cows which calved on Monday were not enrolled into either Group, and were not treated. Each farm followed their usual farming practices for nutrition, animal health, milk production and reproduction for the ensuing mating period.

At each farm, pregnancy testing was undertaken at around 70-90 days following the PSM, and again at 35-70 days after the end of the mating period, to determine the day of conception for all pregnant cows. Age, breed, body condition score (BCS), calving date, conception date and health records for all enrolled cows were retrieved from electronic records (eg Infovet, MINDA).

Calving date relative to planned start of calving (PSC) was expressed within 21 day rounds (Early calving cows: prior to or up to 21 days after PSC; Mid calving cows: 22-42 days after PSC; Later calving cows; 43 days after PSC or later).

Data was collated and analysed to assess the effect of treatment group on pregnancy status at 42 and 84 days after PSM, using a mixed effects logistic regression model including explanatory variables of age, calving round, BCS and breed as fixed effects, and herd as random effect. Analysis was restricted to those animals for whom body condition score data was collected in the correct window relative to calving.

Results

Overall 9,252 lactating mixed-age dairy cows with complete records were available for analysis. No difference was observed between untreated and Group 2 (sterile water) cows, so these groups were combined to form the control population. Valid BCS data was collected for 4,858 animals.

There was no difference between the two treatment groups for calving round (p=0.49) or BCS relative to target BCS at calving (p=0.91; Table 1). However there was a tendency for more Friesians to have been enrolled as treatment cows (p=0.07) and treatment cows were younger than control cows (p=0.027).

Treatment group		Control	eCG
Total n included in analysis		5,604	3,648
Age group	2 year	1,075	779
	3 year	1,029	692
	4-8 year	3,096	1,921
	>8 year	394	250
Average age (years)		4.65	4.5
Breed	Friesian	3,630	2,447
	Crossbred	1,860	1,131
	Jersey	102	60
Calving Round	Early calving	3,472	2,258
	Mid calving	1,385	930
	Later calving	747	460
Calving BCS relative to target	At target	1,523	1,004
	0.5 below target	1,007	694
	1+ below target	386	244
Calving BCS relative to target (BCS)		-0.20	-0.19

Table 1. Descriptive statistics for treatment groups

Univariate Kaplan Meier failure analysis for the entire dataset (unadjusted for age, breed, BCS or herd) showed that median time to conception from PSM was 8 days earlier for all Early calving cows relative to Mid calving cows (19 days vs 27 days respectively), who in turn conceived 17 days earlier than Later calving cows (44 days; Figure 1).

TIME TO PREGNANCY BY CALVING ROUND

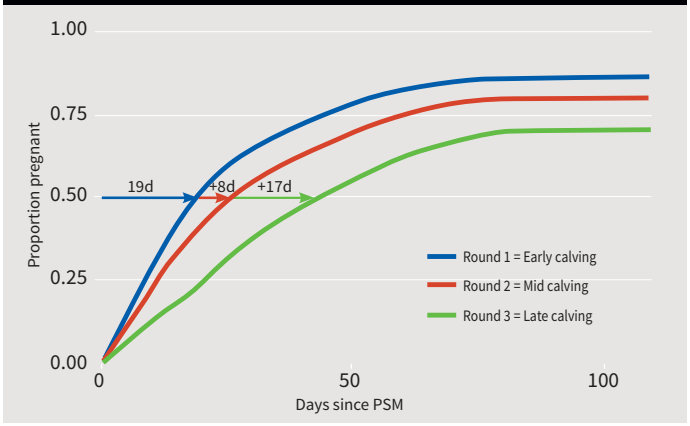

Figure 1. Time to pregnancy by calving round

Median time from PSM to conception for Mid calving cows treated with eCG was 5 days earlier than Control cows (24d vs 29d; Figure2).

MID CALVING COWS - TIME TO PREGNANCY BY CALVING ROUND

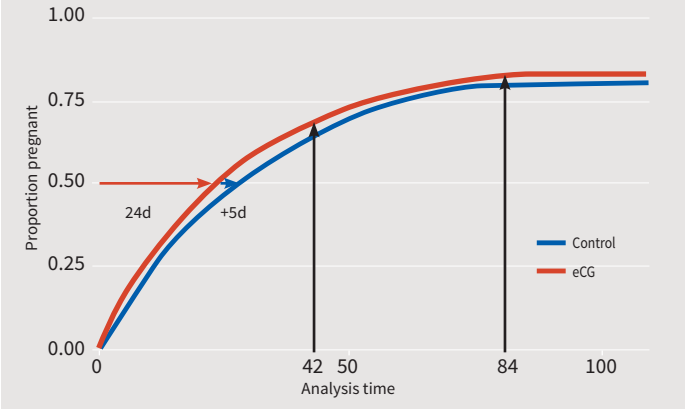

Figure 2. Time to pregnancy by treatment for Mid calving cows

Numerous treatment-by-variable interactions were detected although there was no overall treatment effect on odds of pregnancy at 42 days after PSM (p=0.26).

However, the effect of treatment on pregnancy at PSM+42d differed by calving round: compared to control animals, treatment with eCG resulted in a significant increase in odds of pregnancy (OR=1.26, p=0.003) amongst Mid calving cows. There was a tendency toward increased odds of pregnancy at PSM+42d (OR= 1.12, p=0.09) amongst later calving cows.

A treatment by breed interaction was detected, such that treatment with eCG resulted in higher odds of pregnancy at PSM+42d for crossbred animals (OR=1.16, p=0.01) compared to Friesians.

A treatment by age interaction was significant. Compared to 2 year old animals, treatment with eCG resulted in lower odds of pregnancy at PSM+42d for 3 year old animals (OR=0.51, p=0.04).

Overall, treatment decreased the odds of pregnancy at PSM+84d (OR=0.61, p<0.001) except among Mid calving cows for whom the odds of pregnancy were increased (OR=1.01, p=0.005).

Post estimation marginal analysis with all other variables held at their means indicates an estimated increase in PSM+42d of 4.1% (from 63.6% to 67.7%), and an increase in PSM+84d of 2.4% (from 79.2% to 81.6%) for Mid-calving cows treated with eCG vs Control.

Discussion

Animals with a prolonged (typically greater than 60 days) calving-to-PSM interval did not benefit from eCG administration, and for some parameters it appeared to be detrimental. Conversely, cows with an intermediate calving-to-PSM interval had higher 6 week and 12 week in-calf rates than untreated cows.

Physiologically, these intermediate calvers mimic most closely the experimental design in previous post-partum eCG research[4,8]. It may be that the earlier calving cows had sufficient time to resume cyclicity regardless of treatment group.

The economic return on the routine use of eCG in Mid calving cows can be quantified in one of two ways. Using the DairyNZ InCalf gap calculator values ($4 per cow return per 1% increase in 6 week in-calf rate and $10 per cow return per 1% decrease in not in-calf rate) and an estimated per dose cost of $8.00, the post-estimation marginal analysis predicts approximately a 5-fold Return on Investment (ROI). Alternatively, a milk income calculation can be used based on the unadjusted 5 days in milk improvement seen in the Kaplan Meier failure analysis for treated cows: with animals yielding an additional 1.5kg MS/day at $6.00/kgMS pay out, consuming 8kg additional DMI/day at $0.35/kg DM, an ROI of approximately 2 is achieved.

Conclusion

400 IU equine chorionic gonadotropin (eCG), administered 6 days post-calving, increased pregnancy rates in Mid calving cows. Economic analysis shows a favourable return for treating this group of New Zealand dairy cows where farm systems make it practical.

References

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This study was conducted under approval 14523 of the Ruakura Animal Ethics Committee. eCG used in the study was Novormon eCG (A10641, RVM).