Presynchronization of Suckled Beef Cows with Human Chorionic Gonadotropin (hCG) 7 days prior to Initiation of a Fixed-time Artificial Insemination Protocol Fails to Enhance Fertility

Guilherme Marquezini[1]
Carl Dahlen[1]
G. Cliff Lamb[1]

Administration of human chorionic gonadotropin 7 d before initiating the CO-Synch + CIDR estrous synchronization protocol failed to enhance pregnancy rates. When replacing gonadotropin releasing hormone with human chorionic gonadotropin at the time of insemination, pregnancy rates to fixed-time artificial insemination may be reduced.

Summary

*Two experiments were conducted to evaluate whether hCG administered 7 d before initiating the CO-Synch + CIDR estrous synchronization protocol (Exp. 1 and 2), or replacing gonadotropin releasing hormone (**GnRH**) with human chorionic gonadotropin (**hCG**) at the time of insemination (Exp. 1), would alter pregnancy rate to a fixed-time artificial insemination (**TAI**) in suckled beef cows. In Exp. 1, cows were stratified by days postpartum, age, and parity and randomly assigned to one of four treatments: 1) Cows received GnRH at CIDR insertion (d -7) and 25 mg of prostaglandin $F_{2\alpha}$ (PG) at CIDR removal (d 0), followed in 64 to 68 hr by a TAI with second injection of GnRH at the time of insemination (CG; n=29); 2) same as CG but the second injection of GnRH at the time of insemination was replaced by hCG (CH; n=28); 3) same as GG, but cows received hCG7 d (d -14) priorto CIDR insertion (HG; n=29); and 4) sameas GH, but cows received hCG 7 d (d -14) priorto CIDR insertion (HH; n=29). Pregnancy rates were 52%, 41%, 59%, and 38% for GG, GH, HG, and HH, respectively. Cows receiving hCG(39%) in place of GnRH at TAI tended (P = 0.06) to have poorer pregnancy rates than those receiving GnRH (56%). In Exp. 2, cows were stratified based on days postpartum, body condition score (BCS), breed type, and calf sex and then assigned to the CG (n = 102) or HG (n = 103) treatments. Overall pregnancy rates were 51%, but no differences in pregnancy rates were detected between treatments, breed, days postpartum, or calf sex. We concluded that presynchronization with hCG 7d prior to initiation of the CO-Synch + CIDR protocol failed to enhance pregnancy rates, but replacing GnRH with hCG at the time of AI may reduce pregnancy rates.*

Introduction

Producers are continually seeking to improve reproductive efficiency in cattle. One method of enhancing reproductive efficiency is to utilize estrous synchronization (ES) and AI. Effective TAI systems have been developed (Larson et al., 2006) that reduce the amount of time and labor associated with estrous synchronization and TAI. To ensure the greatest response to ES and AI, increasing the percentage of cows cycling at the beginning of the breeding season is paramount. Therefore, the use of presynchronization to initiate estrous cycles in noncycling cows may enhance the response to the ES and AI protocol. Presynchronization protocols have been developed to increase the rate of ovulation by the first administration of GnRH in a GnRH-PG-GnRH protocol (Busch et al., 2007). Presynchronization of estrus with 2 injections of PG administered 14 d apart, prior to initiating a TAI protocol enhanced pregnancy rates in cows (Moreira et al., 2001; Navanukraw et al., 2004). The improvement of the response of the GnRH is believed to be causedby an increased proportion of cows in early to mid-diestrus when the first GnRH injection of the timed AI protocol was administered, (Vasconcelos et al., 1999; Moreira et al., 2000). The use of hCG induces potent LH activity on ovarian cells, which can even lead to ovulation throughout the estrous cycle.

Our objectives were: 1) to evaluate whether hCG administered 7 d before initiating a TAI estrous synchronization protocol would enhance pregnancy rates; and 2) whether replacing GnRH with hCG at the time of insemination would alter pregnancy rate to TAI.

Materials and Methods

Experiment 1.

One hundred fifteen cows were stratified by days postpartum, age, and parity before being assigned to one of four treatments in a 2 x 2 factorial arrangement (Figure 1): 1) cows received a 100 µg injection of GnRH (OvaCyst; IVX Animal Health) and a CIDR containing 1.38 g of progesterone (Pfizer Animal Health) on d -7 and 25 mg of PG (Lutalyse, dinoprost tromethamine, Pfizer Animal Health) at CIDR removal (d 0), followed in 67 hr by a TAI with second injection of GnRH at the time of insemination (Control GnRH; CG; n=29); 2) same as CG but a second injection of GnRH at the time of insemination was replaced by 1,000 IU of hCG (CH; n=28); 3) same as CG, but cows received 1,000 IU of hCG administered 7 d (d-14) before CIDR insertion (HG; n=29); and 4) same as CH, but cows received 1,000 IU of hCG on d -14 (HH; n=29). Blood samples were collected on d -24, -14,-7, 0, 3, 10 and 16 to harvest serum for analysis of concentration of progesterone. Progesterone concentration was used to determine cycling status. Pregnancy was diagnosed by transrectal ultrasonography 31 d after TAI.

Experiment 2.

Two hundred and five cows were stratified based on days postpartum, BCS, breed type (British or Crossbreed), and calf sex (male or female) and assigned to CG (n= 102) and HG (n = 103) treatments from Experiment 1 (Figure 1). Mean BCS was 5.5 and days postpartum was 70 d. Pregnancy was diagnosed by transrectal ultrasonography on d 29 after TAI.

Results

Experiment 1.

Incidence of cycling, concentrations of progesterone, and pregnancy rates did not differ among the four treatments, but when evaluated as a 2 x 2 factorial differences were detected. Cows receiving no pretreatment (control) or hCG on d -14 are illustrated in Table 1, whereas comparisons between cows treated with GnRH or hCG at TAI (d 3) are illustrated in Table 2. Overall, 55% of cows were cycling by d -14 and did not differ between treatments; however, the percentage of cycling cows tended ($P = 0.10$) to increase by d -7 after receiving hCG (78.9%) compared to untreated controls (64.9%). Subsequently, the concentrations of progesterone (P4) tended ($P = 0.13$) to be greater at the time of CIDR insertion (d -7) in cows receiving hCG compared to untreated controls. The enhanced incidence of more cows with a corpus luteum on d -7 did not appear to enhance fertility. Overall pregnancy rates were 47.4% and were not altered by pretreatment with hCG. However, pregnancy rates tended ($P = 0.06$) to be reduced in cows receiving hCG at TAI compared to those receiving GnRH.

We conclude that hCG appeared to influence the percentage of cows with a corpus luteum on d -7 but failed to enhance fertility when administered 7 d prior to initiation of ES. In addition, replacing GnRH with hCG at TAI appeared to suppress pregnancy rates.

Experiment 2.

Overall pregnancy rates were 51% and did not differ among treatments. In addition, breed, sex of offspring, days postpartum, and parity did not appear to influence pregnancy rates (Table 3). Therefore, we conclude that presynchronization with hCG 7 d prior to initiating the CO-Synch + CIDR protocol, did not enhance pregnancy rates.

Acknowledgements
We thank Pfizer Animal Health (New York, NY) for contributions of prostaglandin $F_{2\alpha}$(Lutalyse) and CIDR inserts and IVX Animal Health (St. Joseph, MO) for donation of gonadotropin-releasing hormone (OvaCyst). Appreciation also is expressed to S. Bird, R. Irurtia, A. Martins, Jr., Olivia Helms, Don Jones, Mary Maddox, Todd Matthews, Harvey Standland, and David Thomas for their assistance with data collection and laboratory analysis.

LITERATURE CITED

Busch et al. 2007. J. Anim. Sci. 85: 1933.
Larson et al. 2006. J. Anim. Sci. 84:332.
Moreira et al. 2001. J. Dairy Sci. 84:1646.
Moreira et al. 2000. J. Anim. Sci. 78:1568.
Navanukraw et al. 2004. J. Dairy Sci. 87:1551.
Vasconcelos et al. 1999. Theriogenology 52:1067.

[1]Guilherme Marquezini, Graduate Student, UF/IFAS, NFREC, Marianna, FL; Carl Dahlen, Graduate Student, University of Minnesota, NWROC, Crookston, MN; G. Cliff Lamb, Associate Professor, UF/IFAS, NFREC, Marianna, FL

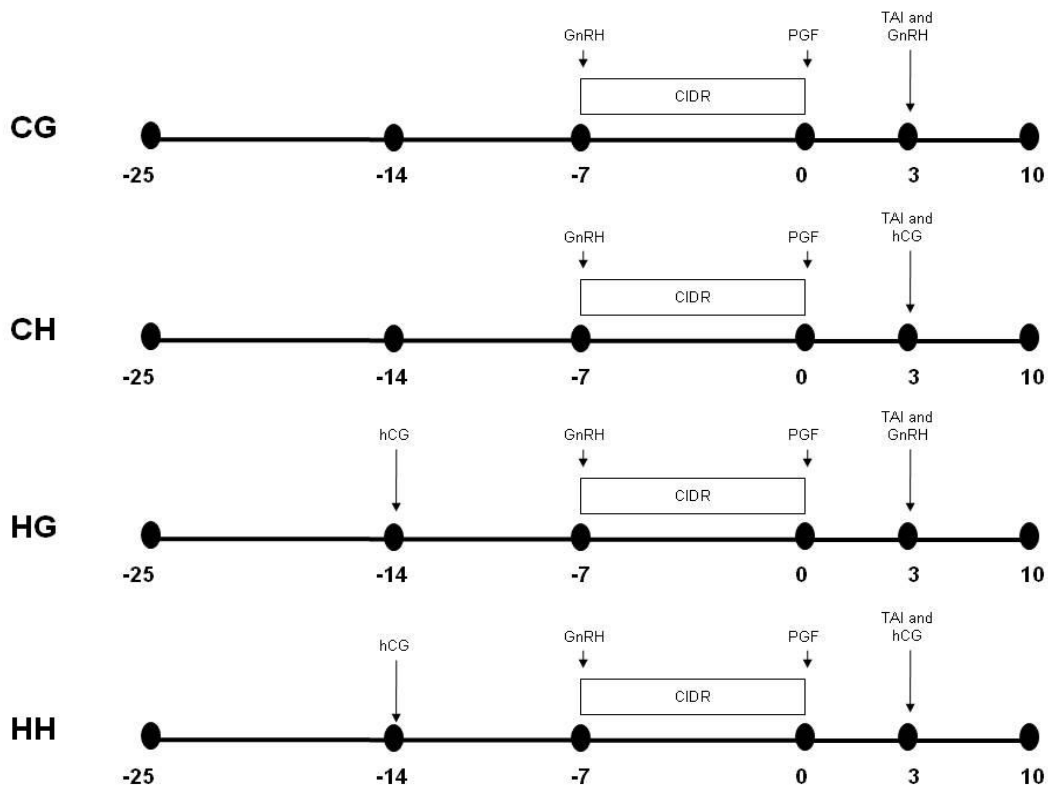

Figure 1. Schematic of experimental design for cows treated with PG, CIDR, and GnRH or hCG in Exp. 1 (CG, CH, HG, and HH) and Exp. 2 (CG and HG).

Table 1. Concentrations of progesterone (P4), percentage of cycling, and pregnancy rates in cows receiving either control or hCG treatment on d -14 (Exp. 1).

	Treatment on d -14[a]	
Item	Control (CG and CH)	hCG (HG and HH)
	----------ng/ml----------	
P4 on d -14, ng/ml	1.6 ± 0.2	1.5 ± 0.2
P4 on d -7, ng/ml	1.9 ± 0.4	2.7 ± 0.4
P4 on d 0, ng/ml	2.5 ± 0.3	3.1 ± 0.3
	----------no./no. (%)----------	
Cycling cows on d -14[b]	31/57 (54.4)	32/57 (56.1)
Cycling cows on d -7[c]	37/57 (64.9)[w]	45/57 (78.9)[x]
Cows with >1 ng/ml P4 on d -14[d]	26/57 (45.6)	27/57 (47.4)
Cows with >1 ng/ml P4 on d -7[d]	23/57 (40.4)[y]	36/57 (63.2)[z]
Pregnancy rates	26/57 (45.6)	28/57 (49.1)

[a]Cows were assigned to receive no treatment or hCG on d -14.
[b]Number and percentage of cows cycling on d -14 based on two blood samples taken on d d -25 and -14.
[c]Number and percentage of cows cycling on d -7 based on three blood samples taken on d d -25, -14, and -7.
[d]Cows with concentrations of P4 >1 ng/ml on d-14 or -7.
[w,x]Percentages differ ($P = 0.10$).
[y,z]Percentages differ ($P < 0.05$).

Table 2. Concentrations of progesterone (P4) and pregnancy rates in cows receiving either GnRH or hCGat TAI on d 3 (Exp. 1).

	Treatment on d 3[a]	
Item	GnRH (CG and HG)	hCG (CH and HH)
	----------ng/ml----------	
P4 on d 3, ng/ml	0.1 ± 0.2	0.2 ± 0.2
P4 on d 10, ng/ml	2.4 ± 0.2	2.3 ± 0.2
P4 on d 16, ng/ml	3.4 ± 0.3	3.4 ± 0.3
P4 on d 29, ng/ml	2.8 ± 0.4	2.6 ± 0.4
	----------no./no. (%)----------	
Pregnancy rates	32/57 (56.1)[x]	22/57 (38.6)[y]

[a]Cows were assigned to receive GnRH or hCG on d 3 (at the time of TAI).
[x,y]Percentages differ (P = 0.06).

Table 3. Pregnancy rates of cows assigned to receive control or hCG treatment on d -14 (Exp.2).

Item	Treatments[a]	
	CG	HG
	----------no./no. (%)----------	
Breed		
Bos taurus	16/37 (43.2)	24/45 (53.3)
Bos indicus crossbred	35/63 (55.6)	26/55 (47.3)
Calf sex		
Female	22/43 (51.1)	22/42 (52.4)
Male	28/55 (50.9)	24/53 (45.3)
Days postpartum		
<60 d	12/25 (48.0)	11/27 (40.7)
>60 d	40/76 (52.6)	39/74 (52.7)
Parity		
Primiparous	10/20 (50.0)	9/25 (36.0)
Multiparous	42/81 (51.9)	41/76 (53.9)

[a]Cows were assigned to receive no treatment or hCG on d -14.