EVALUATION OF HUMAN CHORIONIC GONADOTROPIN AS A REPLACEMENT FOR GnRH IN AN OVULATION SYNCHRONIZATION PROTOCOL BEFORE FIXED-TIME INSEMINATION

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Summary

Two experiments were conducted to evaluate the difference between gonadotropin-releasing hormone (GnRH) and human chorionic gonadotropin (hCG) given at the beginning of a timed AI protocol and their effects on fertility. In Experiment 1, beef cows (n = 672) at six different locations were assigned randomly to treatments based on age, body condition, and days postpartum. On day –10, cattle were treated with GnRH or hCG and a progesterone-releasing controlled internal drug release (CIDR) insert was placed in the vagina. An injection of $PGF_{2\alpha}$ was given and CIDR inserts were removed on day –3. Cows were inseminated at one fixed timed at 62 hr (day 0) after CIDR insert removal. Pregnancy was diagnosed at 33 days (range of 32 to 35) after insemination to determine pregnancy rates. For cows that were pregnant after the first insemination, a second pregnancy diagnosis was conducted 35 days (range of 33 to 37) after the first diagnosis to determine pregnancy survival. Pregnancy rates were reduced by the hCG injection compared with the GnRH injection (39.1 vs. 53.5%). In Experiment 2, cattle were assigned randomly to three treatments, balanced evenly across the two treatments (GnRH vs. hCG) applied in Experiment 1. Cows were injected with GnRH, hCG, or saline seven days before the first pregnancy diagnosis of cows inseminated in Experiment 1. At the time of pregnancy diagnosis, cattle found not pregnant (n = 328) were given $PGF_{2\alpha}$ and inseminated 56 hours later. A second pregnancy diagnosis was conducted 35 days (range of 33 to 37) after the second insemination to determine pregnancy rate at the second AI. Injections of GnRH, hCG, or saline had no effect on pregnancy rates of cows already pregnant to the first insemination. Pregnancy rates after second insemination in cows given an injection of hCG or GnRH, however, tended to be reduced. Percentage of cows pregnant after two timed inseminations exceeded 60% without any need to detect estrus.

Introduction

Timed insemination after the CO-Synch + CIDR protocol generally has produced pregnancy rates more than 50%. The CO-Synch protocol was adapted from the Ovsynch protocol used in the dairy industry. Ovsynch is initiated with an injection of GnRH to induce ovulation of a follicle and is followed in seven days by an injection of PGF. The purpose of the $PGF_{2\alpha}$ injection is to lyse either the corpus luteum formed after GnRH-induced ovulation or the original corpus luteum present at GnRH injection. A second injection of GnRH is usu-

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ally given 48 hours after $PGF_{2\alpha}$ to induce ovulation. Fixed-time insemination is conducted 12 to 24 hours after GnRH. The CO-Synch protocol combines the second GnRH injection and insemination into one step in order to reduce the number of times that cows must be gathered and restrained.

The CO-Synch + CIDR protocol employs a progesterone-releasing, intravaginally-placed controlled internal drug release (CIDR) insert for seven days at the beginning of the ovulation synchronization protocol. Previous work conducted at KSU demonstrated that insemination 56 or 64 hours after the $PGF_{2\alpha}$ injection and CIDR removal resulted in pregnancy rates of 50 to 60%. See the accompanying report entitled "Altered Insemination Timing Improves Pregnancy Rates after a CO-Synch + CIDR Protocol" in this publication.

In previous studies, hCG administered before or after insemination has been effective at inducing ovulation of follicles, lengthening the estrous cycle, increasing size and function of a corpus luteum, and improving cow fertility. Human chorionic gonadotropin is more effective than GnRH at stimulating ovulation in dairy cattle. Therefore, our objective was to substitute hCG for GnRH in two different ovulation-synchronization protocols and assess its effects on fertility of lactating beef cows. The protocol could potentially allow cattle producers to inseminate cows twice during the first 35 days of the breeding season and still have sufficient time for a 25-day natural-service period in a 60-day breeding season.

Experimental Procedures

Ovulation in beef cattle at six different locations were synchronized using a CO-Synch + CIDR protocol, and then ovulation was resynchronized 26 days (range of 25 to 28) after the first timed AI. Locations of cattle assigned to treatments included 1) purebred Angus, Hereford, and Simmental cows (n=106) at the Kansas State University Purebred Beef Unit; 2) Angus × Hereford crossbred cows (n = 277) at the Kansas State University Commercial Cow-Calf Unit; 3) Angus, Hereford, and Simmental crossbred cows (n = 181) at the Thielen Ranch, Dorrance, KS; and 4) purebred Angus cows (n = 116) at the North Central Research and Outreach Center, University of Minnesota, Grand Rapids, MN.

In Experiment 1, ovulation in beef cattle was synchronized using a CO-Synch + CIDR protocol (Figure 1). A CIDR was inserted and 100 μg of GnRH (2 mL of OvaCyst, IVX Animal Health, St. Joseph, MO) or 1,000 IU of hCG (1 mL of Chorulon, Intervet Inc., Millsboro, DE) was given intramuscularly on day −10. On day −3, the CIDR was removed and 25 mg of $PGF_{2\alpha}$ (ProstaMate, IVX Animal Health) was injected intramuscularly. Fixed-time insemination was carried out 60 to 64 hours (day 0) after $PGF_{2\alpha}$ injection. Pregnancy was diagnosed 33 days after insemination. For cows diagnosed pregnant at that time, pregnancy survival was verified 35 days later (68 days after the first timed AI).

In Experiment 2, seven days before all cows in Experiment 1 were diagnosed for pregnancy, each cow of unknown pregnancy status received either 2 mL of OvaCyst, 1 mL of Chorulon, or 2 mL of saline (control) on day 26 after the first insemination. On day 33, pregnancy diagnosis was carried out by using transrectal ultrasonography, and cattle that were not pregnant were given 5 mL of Prostamate. Cattle that received Prostamate received one fixed-time insemination 56 hours later. Pregnancy was diagnosed 35 days after this insemination.

Results and Discussion

Pregnancy rates after the first timed AI are summarized in Table 1. Injection of GnRH resulted in greater (P<0.001) pregnancy rates than hCG (53.7 vs. 39.1%). Injection of

GnRH, hCG, or saline (Experiment 2) had no effect on first insemination pregnancy rates (GnRH = 47.1%, hCG = 45.4%, or saline = 46.9%). Pregnancy survival did not differ between GnRH and hCG treatments in those cows that conceived after the first insemination (Table 1).

Pregnancy rates of cows in Experiment 2 are summarized in Table 2. Injections of GnRH and hCG, compared with saline, tended (P = 0.07) to reduce second-service pregnancy rates. Future experiments should be conducted to address whether GnRH or hCG is needed in this resynchronization application for beef cattle.

In the current experiments, cattle that were not pregnant after the first insemination (Experiment 1) were treated with either GnRH, hCG, or saline (Experiment 2) seven days before the first pregnancy diagnosis. Within 35 days of the beginning of the breeding season, cattle had 2 chances to conceive to AI and no detection of estrus was necessary. Pregnancy rates after two timed inseminations are summarized in Table 1. Rates ranged from 56.8 to 67.9%, but did not differ among treatments.

Implications

The AI protocols examined in these experiments allow cattle producers to inseminate cows twice during the first 35 days of the breeding season and still have sufficient time for a 25-day natural-service period in a 60-day breeding season. These protocols were designed for cattle producers who do not have the labor or facilities to detect estrus. Injection of hCG had a negative effect on pregnancy rates of cattle treated with the CO-Synch + CIDR protocol in Experiment 1 and therefore is not a suitable replacement for GnRH. In Experiment 2, it was concluded that a GnRH or hCG injection may not be necessary to initiate a CO-Synch protocol for cows identified as not pregnant by transrectal ultrasound 33 days after AI. Further work is needed to verify this finding.

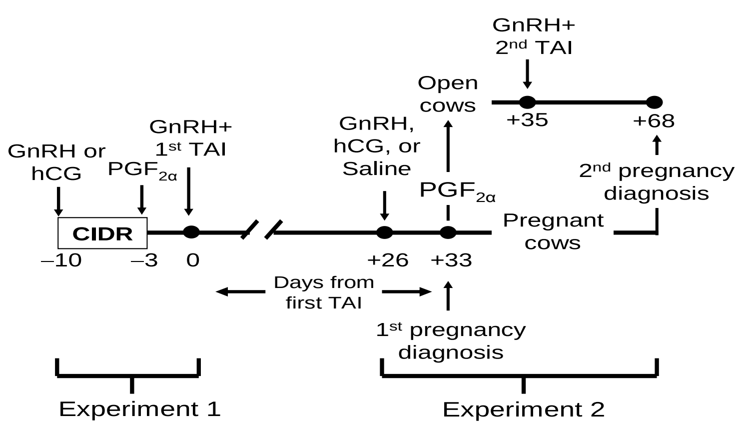

Figure 1. Experimental Design for Experiments 1 and 2.

Table 1. Pregnancy Rates and Pregnancy Survival Rates After the First Timed AI

Experiment 1 Treatments	Experiment 2 Treatments	Pregnancy Rate at First AI, %	Pregnancy Survival Between First AI and 68 Days Since AI, %	Pregnancy Rate After Two Inseminations
		% (no.)		
GnRH	Saline	54.5 (112)	90.2 (61)	67.9 (112)
	GnRH	55.2 (116)	92.2 (64)	64.3 (115)
	hCG	51.4 (109)	96.4 (56)	65.1 (109)
	Total	53.7[a] (337)	92.8 (181)	65.8 (336)
hCG	Saline	39.1 (110)	93.0 (43)	62.7 (110)
	GnRH	38.3 (107)	97.6 (41)	61.7 (107)
	hCG	39.8 (118)	95.7 (46)	56.8 (118)
	Total	39.1 (335)	95.4 (130)	60.3 (335)

[a]Different (*P*<0.001) from hCG.

Table 2. Pregnancy Rates of Cows Reinseminated at 56 Hours After $PGF_{2\alpha}$ (injected at the time of not-pregnant diagnosis; Experiment 2)

Treatment (Experiment 1)	Treatment (Experiment 2) Saline	GnRH	hCG
	% (no.)		
GnRH	40.0 (45)	26.1 (46)	29.2 (48)
hCG	40.3 (62)	37.7 (61)	31.8 (66)
Total	40.2[a] (107)	32.7 (107)	30.7 (114)

[a]Tended (*P* = 0.07) to differ from hCG + GnRH.