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Ovulation potential of human chorionic gonadotropin versus GnRH

Abstract

Experiments have shown human chorionic gonadotropin (hCG) to be more effective than GnRH as a means to induce ovulation of follicles. Dosages used, however, have differed greatly among experiments. A study was performed to determine the minimum effective dose of hCG needed to induce ovulation of ovarian follicles in dairy cows. Ovaries of Holstein cows were mapped by using transrectal ultrasonography 7 days before a bi-weekly pregnancy diagnosis. Cows were assigned randomly to treatments of saline, 100 µg of GnRH (2 mL of Fertagyl, Intervet, Inc., Millsboro, NJ), or 500, 1000, 2000, or 3000 IU of hCG (0.5, 1, 2, or 3 mL of Chorulon, Intervet, Inc., Millsboro, NJ). Ovarian structures were monitored again 7 days later, and the proportion of cows, and proportion of follicles ≥ 8 mm in diameter, that ovulated were recorded. A dose of at least 1000 IU of hCG resulted in a greater ovulatory response than saline, GnRH, or 500 IU of hCG.; Dairy Day, 2006, Kansas State University, Manhattan, KS, 2006;

Keywords

Diary Day, 2006; Kansas Agricultural Experiment Station contribution; no. 07-118-S; Report of progress (Kansas State University. Agricultural Experiment Station and Cooperative Extension Service); 965; Dairy; GnRH; hCG; Ovulation

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OVULATION POTENTIAL OF HUMAN CHORIONIC GONADOTROPIN VERSUS GnRH

B. S. Buttrey, M. G. Burns, and J. S. Stevenson

Summary

Experiments have shown human chorionic gonadotropin (hCG) to be more effective than GnRH as a means to induce ovulation of follicles. Dosages used, however, have differed greatly among experiments. A study was performed to determine the minimum effective dose of hCG needed to induce ovulation of ovarian follicles in dairy cows. Ovaries of Holstein cows were mapped by using transrectal ultrasonography 7 days before a bi-weekly pregnancy diagnosis. Cows were assigned randomly to treatments of saline, 100 µg of GnRH (2 mL of Fertagyl, Intervet, Inc., Millsboro, NJ), or 500, 1000, 2000, or 3000 IU of hCG (0.5, 1, 2, or 3 mL of Chorulon, Intervet, Inc., Millsboro, NJ). Ovarian structures were monitored again 7 days later, and the proportion of cows, and proportion of follicles ≥ 8 mm in diameter, that ovulated were recorded. A dose of at least 1000 IU of hCG resulted in a greater ovulatory response than saline, GnRH, or 500 IU of hCG.

(Key Words: GnRH, hCG, Ovulation.)

Introduction

Estrus-synchronization and ovulation-control protocols that facilitate fixed-time insemination (TAI) have been a reality for several years. Although these programs offer the opportunity to facilitate the use of TAI without detection of estrus, conception rates have historically been compromised. Most of these schemes traditionally use GnRH to control

follicular development and induce ovulation of a dominant follicle. Research has shown, however, that the human hormone hCG is more effective than GnRH at causing these follicles to ovulate. Although hCG acts to prevent luteolysis and maintain pregnancy by induction of ancillary luteal structures in humans, hCG has an LH-like activity in cattle and other species. The purpose of this study was to determine the minimum, most-effective dose of hCG needed to induce ovulation follicles ≥ 8 mm in diameter in cattle.

Procedures

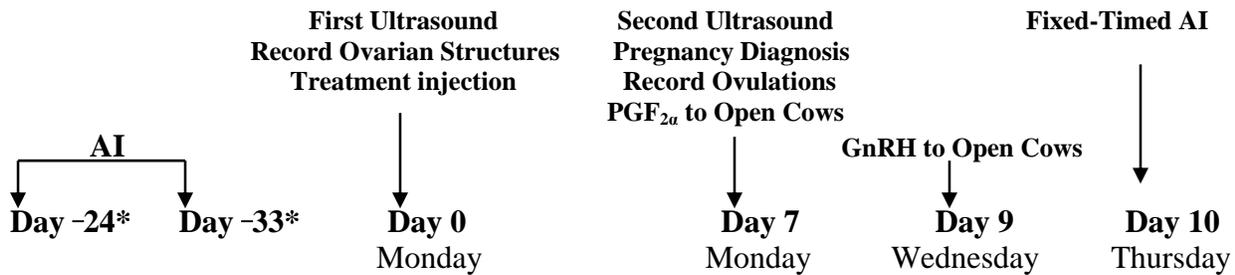
Ovaries of Holstein cows and heifers at the Kansas State University Dairy Teaching and Research Center were examined by transrectal ultrasonography, and structures were mapped, sized, and recorded. Cattle received a treatment of saline, GnRH, or one of 4 doses of hCG. Descriptions of treatments are illustrated in Figure 1. Cows were then re-examined 1 week later, and those follicles that were induced to ovulate were noted.

Results and Discussion

Results of this experiment are summarized in Table 1. Ovulatory responses (shown as the percentage of cows with a new corpus luteum, in Table 1) per female treated with saline, GnRH, or 500 IU of hCG were exceeded ($P < 0.05$) by the larger doses (1000 IU or greater) of hCG. When the combined hCG doses ≥ 1000 IU were compared with only saline, the P value was = 0.06. More than

95% of the females had at least 1 follicle ≥ 8 mm in diameter. Number of follicles at least ≥ 8 mm in diameter per female averaged approximately 2 in each group of females before treatment. When ovulatory response was calculated based on the total numbers of follicles, percentage responses were similar to those on a per-cow basis. Compared with saline, GnRH, and 500 IU of hCG, the greater doses of hCG produced ($P < 0.05$) more ovulations. A tendency ($P = 0.12$) for more follicles to ovu-

late after at least 1000 IU of hCG than after saline alone. Some ovulations in each treatment were spontaneous due to the stage of cycle at treatment, and some corpora lutea were immature at the time of first observation and were not visible until the second examination occurred 7 days later. The study shows that a dose of 1000 IU of hCG exceeds the ovulatory capacity of saline, GnRH, and the smallest dose of hCG (500 IU) in these dairy females.



*Due to biweekly schedule, cows varied between 24 and 33 days post-AI at time of first ultrasound examination and treatment.

Figure 1. Treatment Scheme for Monitoring Ovulatory Capacity of GnRH and Various Doses of Human Chorionic Gonadotropin, Relative to Saline Injection.

Table 1. Ovulatory Response 7 Days after Saline, GnRH, and hCG

Item	Saline	GnRH	Dose of hCG, IU			
			500	1000	2000	3000
No. of dairy females ¹	19	18	18	18	17	16
Females having a new corpus luteum, %	42.1	50.0	44.4	66.7 ^a	64.7 ^a	68.8 ^a
No. of females having at least 1 follicle ≥ 8 mm in diameter	16	18	17	18	17	15
Avg. no. follicles ≥ 8 mm per female	1.9	1.9	1.8	1.8	1.8	2.1
Follicles ≥ 8 mm that ovulated, %	30.0 (30) ²	34.3 (35)	30 (30)	46.9 ^b (32)	43.3 ^b (30)	48.4 ^b (31)

^aCombined doses of hCG (≥ 1000 IU) tended ($P = 0.06$) to differ from saline; compared with saline, GnRH, and the smallest dose of hCG, a difference ($P < 0.05$) occurred.

^bCombined doses of hCG (≥ 1000 IU) tended ($P = 0.12$) to differ from saline; compared with saline, GnRH, and the smallest dose of hCG, a difference ($P < 0.05$) occurred.

¹Included a few nulliparous heifers.

²No. of follicles per group.