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Short communication

Ovarian follicular and corpus luteum changes, progesterone concentrations, estrus and ovulation following estradiol benzoate/progesterone based treatment protocol in cross-bred cows

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Abstract

The objectives of the present study were to investigate the effects of the stage of the estrous cycle at the start of an estradiol benzoate (EB) and progesterone (P) based treatment protocol on new follicular wave emergence, subsequent estrus and ovulation. The experiment was conducted using a crossover design with each cow (five cross-bred cows) being assigned to one of three groups at 3-month intervals within a 1-year period. Estrous cycle stage in individual cows was initially synchronized with prostaglandin $F_2\alpha$. After detection of estrus, each cow was injected intramuscularly (i.m.) with 2 mg EB and 200 mg P (EB/P) on day 5, 12 or 17 of the estrous cycle (estrus = day 0), followed by 1 mg EB i.m. 12 days after the EB/P treatment. Ovarian ultrasonographic examinations showed that the emergence of a new follicular wave occurred after EB/P treatment in all groups and the mean interval from EB/P treatment to wave emergence did not differ among the groups (3.2–3.8 days). All cows in each group exhibited behavioral estrus and ovulated the newly formed dominant follicle. However, cows in the day-17 group exhibited estrus 1–3 days before the second EB injection. The concentrations of progesterone showed faster reduction, during the treatment period, in the day-12 and -17 groups compared to the day-5 group. These results indicate that the EB/P treatment induces an emergence of a new follicular wave, irrespective of the estrous cycle stage at the start of treat-

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ment, but the effect of EB/P protocol on estrous/ovulation synchronization is influenced by the stage of the estrous cycle.

Keywords: Estrus; Dominant follicle; Synchronization; Estradiol benzoate; Progesterone

1. Introduction

Exogenous estrogen treatment with progesterone can be used effectively to control and synchronize follicular wave development. The administration of estrogen to progestogen-treated cattle suppresses the growth of the dominant follicle, and induces the emergence of a new wave of ovarian follicles (Bo et al., 2002). Bo et al. (1995) demonstrated that the emergence of a new follicular wave occurs 4.3 days after treatment with estrogen and progestogen. However, the intervals from estrogen treatment to a new follicular wave emergence and estrus are still variable (Roche et al., 1999). Irrespective of endocrine status and stage of follicular wave at the start of the treatment, the precise onset of estrus/ovulation and normal fertility after a single insemination is required for successful estrous/ovulation synchronization. To date, most recent protocols in progesterone-based estrous synchronization use the progestogen implant or progesterone device in combination with estrogen to suppress synergistically LH pulse frequency and to cause atresia of the dominant follicle, respectively (Price and Webb, 1988). The use of a progesterone device as a short-term source of exogenous progesterone is not economical for use in commercial estrous/ovulation synchronization and artificial insemination programs. However, there is little information concerning the estrous/ovulation synchronization by intramuscular administration of estrogen and progesterone injection without the progestogen implant or progesterone device.

In the present study, we investigated the effects of the stage of the estrous cycle at the start of estradiol benzoate and progesterone injection based protocol on new follicular wave emergence, corpus luteum function, subsequent estrus and ovulation.

2. Materials and methods

Five cross-bred cows (Japanese Black beef sire × Holstein cow, 5–10 years old) with regular estrous cycles were selected from our research herd. The experiment was conducted using a crossover design with each cow being assigned to each of three groups at 3-month intervals within a 1-year period. The stage of the estrous cycle in each cow was initially synchronized with prostaglandin $F_2\alpha$ ($PGF_2\alpha$; Resipron-C®, Teikokuzoki, Co., Ltd., Tokyo, Japan, 500 μg i.m.). Estrus detection was performed by visual observation conducted twice daily for 7 days following the injection of $PGF_2\alpha$. After detection of estrus by visual observation and subsequent ovulation by ultrasonographic examination described below, each cow was injected intramuscularly (i.m.) with 2 mg estradiol benzoate (EB; Estradiol benzoate, KawasakiMitaka K.K., Tokyo, Japan) and 200 mg progesterone (P; Ovapron. KawasakiMitaka K.K.) (EB/P) on day 5, 12, or 17 of the estrous cycle (estrus = day 0), followed by 1 mg EB i.m. 12 days after the EB/P treatment. Estrus was monitored by visual observation conducted twice daily for 3 days before and after second EB injection. Progesterone dose was chosen to obtain plasma concentrations greater than those observed in the middle of the diestrus phase of the estrous cycle. The dose of 200 mg was greater than that previously reported by Adams et al. (1992), who administered 150 mg from days 6 to 20 to maintain the concentrations in plasma equivalent to those in diestrus phase.