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Effect of timing of estradiol benzoate administration upon synchronization of ovulation in suckling Nelore cows (*Bos indicus*) treated with a progesterone-releasing intravaginal device

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Abstract

The present study investigated how the timing of the administration of estradiol benzoate (EB) impacted the synchronization of ovulation in fixed-time artificial insemination protocols of cattle. To accomplish this, two experiments were conducted, with EB injection occurring at different times: at withdrawal of the progesterone-releasing (P4) intravaginal device or 24 h later. The effectiveness of these times was compared by examining ovarian follicular dynamics (Experiment 1, $n = 30$) and conception rates (Experiment 2, $n = 504$). In Experiment 1, follicular dynamics was performed in 30 Nelore cows (*Bos indicus*) allocated into two groups. On a random day of the estrous cycle (Day 0), both groups received 2 mg of EB i.m. and a P4-releasing intravaginal device, which was removed on Day 8, when 400 IU of eCG and 150 μg of PGF were administered. The control group (G-EB9; $n = 15$) received 1 mg of EB on Day 9, while Group EB8 (G-EB8; $n = 15$) received the same dose a day earlier. Ovarian ultrasonographic evaluations were performed every 8 h after device removal until ovulation. The timing of EB administration (Day 8 compared with Day 9) did affect the interval between P4 device removal to ovulation (59.4 ± 2.0 h compared with 69.3 ± 1.7 h) and maximum diameter of dominant (1.54 ± 0.06 a cm compared with 1.71 ± 0.05 b cm, $P = 0.03$) and ovulatory

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(1.46 ± 0.05 a cm compared with 1.58 ± 0.04 b cm, $P < 0.01$) follicles. In Experiment 2, 504 suckling cows received the same treatment described in Experiment 1, but insemination was performed as follows: Group EB8-AI48h (G-EB8-AI48h; $n = 119$) and Group EB8-AI54h (G-EB8-AI54h; $n = 134$) received 1 mg of EB on Day 8 and FTAI was performed, respectively, 48 or 54 h after P4 device removal. Group EB9-AI48h (G-EB9-AI48h; $n = 126$) and Group EB9-AI54h (G-EB9-AI54h; $n = 125$) received the same treatments and underwent the same FTAI protocols as G-EB8-AI48h and G-EB8-AI54h, respectively; however, EB was administered on Day 9. Conception rates were greater ($P < 0.05$) in G-EB9-AI54h [63.2% (79/125) a], G-EB9-AI48h [58.7% (74/126) a] and G-EB8-AI48h [58.8% (70/119) a] than in G-EB8-AI54h [34.3% (46/134) b]. We concluded that when EB administration occurred at device withdrawal (D8), the interval to ovulation shortened and dominant and ovulatory follicle diameters decreased. Furthermore, when EB treatment was performed 24 h after device removal, FTAI conducted at either 48 or 54 h resulted in similar conception rates. However, EB treatment on the same day as device withdrawal resulted in a lesser conception rate when FTAI was conducted 54 h after device removal.

Keywords: Cattle—fixed-time artificial insemination; Follicular dynamics; Ovulation; Pregnancy; Estradiol benzoate

1. Introduction

More efficient management practices in cattle operations are important for maximizing profitability. An important consideration in increasing net returns is optimizing reproductive efficiency. The use of animal breeding technologies have increased, particularly in tropical and subtropical areas where artificial insemination (AI) is the only alternative for introducing *Bos taurus* genes into production units. In *Bos indicus* cows, detection of estrus is difficult due to a number of factors including the incidence of postpartum anestrus. Furthermore, zebu cattle appear to experience estrus nocturnally and for a short duration, making AI difficult and impractical in these animals (Baruselli et al., 2004a). However, recent hormonal treatments designed to control both luteal and follicular function permit exciting possibilities for synchronization of time of ovulation without the need for detection of estrus (Bó et al., 2002a).

The concurrent use of progesterone (P4) intravaginal devices and estradiol benzoate (EB) is one of the most popular treatments for fixed-time artificial insemination (FTAI) in beef and dairy cattle (Macmillan and Peterson, 1993; Macmillan and Burke, 1996; Bó et al., 2002a,b). The standard treatment for *B. indicus* cattle is similar to that for *B. taurus* and consists of the administration of 2 mg of EB i.m. at the time of P4 device insertion (Day 0), device removal and administration of prostaglandin (PGF) i.m. on Day 7 or 8, and 1 mg EB i.m. 24 h later (Macmillan and Burke, 1996). Then FTAI is generally performed 52–56 h after device removal in *B. indicus* cattle, with minimal opportunity of altering this time frame (Baruselli et al., 2001).

Notwithstanding, the second EB treatment (1 mg EB i.m.) given 24 h after device removal is essential, because it results in a more synchronous time of preovulatory gonadotropin surge, a more synchronized time of ovulation (Cutaia et al., 2001; Bó et al., 2002a; Marques et al., 2003) and greater pregnancy rates (Colazo et al., 1999; Moura et al., 2003) compared with groups not receiving this treatment. In contrast to the many reports that recommend synchronizing time of ovulation via injection of EB 24 h after device removal (Bó et al., 2002a; Martinez et al., 2002, 2005; Baruselli et al., 2004b), some studies demonstrated the possibility of utilizing estradiol cypionate (EC) at removal of the progestin/progesterone device to minimize animal handling (Colazo et al., 2003; Marques et al., 2004; Penteado et al., 2005; Ayres et al., 2006). Addition-