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Progesterone concentration, follicular development and induction of cyclicity in dairy cows receiving intravaginal progesterone inserts

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Abstract

Objectives were to evaluate progesterone concentrations after cows had initiated estrous cycles following calving and induction of estrous cycles in postpartum anovular high-producing Holstein dairy cows treated with controlled internal drug releasing (CIDR). In experiment 1 (EXP1), 62 cows that had initiated estrous cycles received a new CIDR (NCIDR) containing 1.38 g of progesterone or a 7-d used autoclaved CIDR (UCIDR) 48 h after luteolysis for 7 d. Ovaries were examined by ultrasonography, and plasma analyzed for concentrations of progesterone. In experiment 2 (EXP2), 515 cows diagnosed as anestrus were randomly assigned to untreated control, NCIDR or UCIDR for 6 d. Plasma was analyzed for concentration of progesterone 12 d after CIDR removal to determine ovulation. In EXP1, milk yield and body condition did not influence progesterone concentrations. Concentration of progesterone tended to increase faster ($P = 0.10$) in cows receiving UCIDR than NCIDR, but both treatments reached a plateau at 90 min. Cows receiving the NCIDR had greater ($P = 0.04$) concentrations of progesterone during the 7-d treatment, but they were mostly subluteal (<1.0 ng/mL) after d 2. After removal, concentrations of progesterone were greater for NCIDR than UCIDR for the first 45 min, and were similar thereafter. Multiparous cows had lesser ($P = 0.004$) concentrations than primiparous cows throughout the study. The pattern of ovarian follicular development was not affected by treatment. In EXP2, induction of onset of estrous cycles increased ($P < 0.01$) with progesterone treatments, but was similar between NCIDR and UCIDR. Proportion of cows experiencing shorter than typical length estrous cycles after first AI tended to be greater ($P = 0.09$) for control cows than those receiving the CIDR, and for cows remaining anestrous than those in which onset of estrous cycles was induced. Pregnancy per AI and pregnancy loss were similar among treatments. Cows that resumed estrous cyclicity prior to first AI had greater ($P = 0.01$) pregnancy per AI. Treatment of high-producing Holstein cows that had previously initiated onset of estrous cycles with CIDR resulted in subluteal concentrations of

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progesterone, but in anestrous high-producing cows increased induction of estrous cycles with no effect on fertility at first insemination.

Keywords: Anestrous; CIDR; Dairy cow; Progesterone

1. Introduction

In high-producing dairy herds, 6–59% of the postpartum Holstein cows have not resumed estrous cyclicity by 60-d postpartum or before the first postpartum AI (Cerri et al., 2004; Santos et al., 2008; Stevenson et al., 2006). These cows have a lesser probability of pregnancy per AI and increased pregnancy losses following the first insemination (Chebel et al., 2006; Santos et al., 2004; Stevenson et al., 2006). Because delayed resumption of first postpartum ovulation is prevalent in high-producing dairy cows and has a negative impact on fertility, it is plausible to speculate that methods that induce onset of estrous cycles in anestrous cows are expected to improve reproductive performance.

The controlled internal drug releasing (CIDR) is an intravaginal device that sustains concentrations of progesterone in plasma sufficient to block an LH surge and prevent ovulation (Savio et al., 1993). Studies have been conducted using CIDR inserts for synchronization of return to estrous in nonpregnant cows (Chenault et al., 2003) or incorporation into synchronization of ovulation protocols (Galvão et al., 2004; Stevenson et al., 2006). A limited number of studies, however, have addressed the use of CIDR to induce onset of estrous cycles and improve fertility in high-producing anestrous dairy cows. Gümen and Wiltbank (2005) demonstrated that the normal response of the hypothalamic-pituitary axis to estrogen was re-established in anestrous cows after treatment that resulted in subluteal concentrations of progesterone for 3 d. Treatment of anestrual high-producing dairy cows with CIDR increased the probability of onset of estrous cycles, but approximately 50% of the anestrous cows did not respond to treatment (Chebel et al., 2006).

Systemic concentrations of progesterone in cows can be influenced by feed intake and catabolism of steroids, but also by body weight (BW) when intravaginal inserts containing progesterone are used. Sangsritavong et al. (2002) and Vasconcelos et al. (2003) found that increased feed intake reduced steroid concentrations because of the increased hepatic blood flow and potentially greater clearance of hormones by the liver. Progesterone concentrations during treatment with the CIDR are well documented in dairy cows in pasture-based systems (Nation et al., 2000), but the response to CIDR treatment may be different in high-producing dairy cows in confinement systems because of different managerial conditions, feed intake, milk yield and BW.

Although not recommended, re-use of CIDR is a common practice in dairy herds. Based on release profiles (Rathbone et al., 2002), the insert with 1.38 g of progesterone is sufficient for a 14-d treatment period. Objectives in experiment 1 (EXP1) were to determine the profile of progesterone and ovarian follicular dynamics in cows after insertion of a new or a 7-d used autoclaved CIDR in high-producing dairy cows that had previously initiated estrous cyclicity. In experiment 2 (EXP2), objectives were to evaluate efficacy of these inserts in inducing resumption of estrous cycles in high-producing anestrous cows and its subsequent effects on establishment and maintenance of pregnancy. It was hypothesized that treatment with CIDR would improve resumption of estrous cycles in anestrous cows. It was also hypothesized that cows receiving a 7-d used autoclaved CIDR would maintain similar concentrations of progesterone compared with a