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Evaluation of short estrus synchronization methods in dairy cows☆

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Abstract

In the present study, two new short estrus synchronization methods have been developed for lactating dairy cows. The study was completed in three consecutive phases. In experiment (Exp) 1, 32 cows, that were not detected in estrus since calving between the 50th and 84th post-partum days, were treated with PGF2α (PGF, D-cloprostenol, 0.150 mg), estradiol propionate (EP, 2 mg) and GnRH (lecirelina, 50 μg) at 24 h intervals, respectively, and timed artificial insemination (TAI) was performed 48 h after PGF. Different from Exp 1, EP and GnRH were given at 48 and 60 h, respectively after PGF in Exp 2 ($n = 20$), instead of 24 and 48 h. Ovulations were investigated by ultrasound for 7 days starting from the day of PGF treatment, and ovulation rates were compared with the ones obtained in Exp 1. In Exp 3, cows were given the same treatments as Exp 2, but treatments started at certain estrus stages. Cows detected in estrus and with a confirmed ovulation ($n = 27$) after the second PGF given 11 days apart were assigned to three treatment groups. Treatment was initiated at Day 3 (group metestrus, $n = 9$), Day 12 (group diestrus, $n = 9$) and Day 18 (group proestrus, $n = 9$) after ovulation. All cows included in Exp 3 were TAI between 16 and 20 h after GnRH treatment. In Exp 2 and 3, blood samples were obtained once every 2 days, starting from Day 0 to the 10th day after GnRH injection, and once every 4 days between the 10th and the 22nd days after GnRH to examine post-treatment luteal development. During the study, animals exhibiting natural estrus were inseminated and served as controls

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($n = 85$). The rate of estrus was found to be significantly higher in cows with an active corpus luteum (CL) at the start of Exp 1 (72.7% vs. 30.0%, $P < 0.05$) and the pregnancy rate tended to be higher than cows without an active CL (40.9% vs. 10.0%, $P = 0.08$). Compared to those in Exp 1, cows in Exp 2 had higher rates of synchronized ovulation (94.1% vs. 59.1%, $P = 0.013$). In Exp 3, estrus ($P < 0.001$) and pregnancy rates ($P = 0.01$) were found to be significantly higher in cows in the proestrus group than in those in the metestrus group. Comparable pregnancy rates were obtained from the first and second inseminations in Exp 1 and 3 with results from those inseminated at natural estrus ($P > 0.05$).

It was concluded from the study that the treatment in Exp 1 and 3 could result in comparable pregnancy rates after timed AI of lactating dairy cows at random stages of the estrus cycle relating to those inseminated at natural estrus, but the stage of the estrus cycle can have significant effects on pregnancy rates.

Keywords: Dairy cows; Short synchronization; PGF2α; GnRH; Estradiol propionate

1. Introduction

Failure to detect cows in estrus accurately is a major factor limiting the reproductive performance of lactating dairy cattle and this is the main reason for the increase in the calving interval in many dairy herds (Rounsaville et al., 1979). It has been estimated that the mean reduction in the net revenue from a 1-day increase in adjusted calving interval is $4.7 (Canadian) per cow (Plaizier et al., 1997). A fixed-time AI facilitates precise scheduling of first post-partum AI, while improving reproductive performance during the early post-partum period with no labour investment for estrus detection (DeJarnette et al., 2001). Various estrus synchronization programs allowing timed artificial insemination (TAI) have been developed in cows, but most require several days to sort cows in order to administer the treatment, and it is difficult to reduce the interval between the start of treatment and AI to less than 9 d (López-Gatius, 2000b). Development of short synchronization methods that would result in acceptable pregnancy rates as a result of TAI would provide breeders with certain advantages. This would rid the breeders of the burden of determining the estrus, all cows treated following the voluntary waiting period would be inseminated, and early completion of treatment would save breeders time. However, there are only a limited number of studies on the short synchronization programs for TAI, in which cows having a determinable corpus luteum (CL) have been used (López-Gatius, 1989, 2000a; López-Gatius and Vega-Prieto, 1990). In an earlier study, we determined that an additional estradiol propionate (EP) injection (GPEG; Day 0/GnRH, Day 7/$PGF_{2\alpha}$, Day 8/EP, Day 9/GnRH) on Day 8 of the ovsynch protocol (GPG) shortened the PGF treatment to ovulation interval approximately 4 h ($P > 0.05$) and increased the pregnancy rate slightly (50.0% vs. 60.0%, $P > 0.05$) in lactating primiparous Holstein cows (Cirit et al., 2007). These findings encouraged us for the fact that short-term treatment without the first GnRH injection can allow for TAI.

The simultaneous administration of hCG and estradiol benzoate 12 h after prostaglandin treatment in dairy cows with mature CL has been reported to allow TAI 48 h after starting treatment (López-Gatius, 2000a). To our knowledge, there is no study about the effects of short synchronization methods on random or known different stages of estrus cycles in lactating cows. Additionally, information in related subjects like synchronized ovulation rates and post-treatment luteal development is absent, except the effects of the treatments over the rates of estrus and pregnancy, since all the existing work is field-based studies. In cows, abnormal luteal function, delayed onset of luteal phase or decreased progesterone concentrations has been shown associated with reduced pregnancy rates (Larson et al., 1997).