

Short Paper

The effect of administration of gonadotropin releasing hormone analogue at estrus or during luteal phase on reproductive performance of dairy cows maintained under sub-temperate climate

Jaswal, R. S.¹ and Singh, M.^{2*}

¹MVSc in Animal Reproduction, Gynecology and Obstetrics, Department of Animal Husbandry, Veterinary Polyclinic Bhangrotu, Himachal Pradesh, India; ²Department of Veterinary Gynecology and Obstetrics, College of Veterinary and Animal Sciences, Himachal Pradesh Agricultural University, Palampur, India

*Correspondence: M. Singh, Department of Veterinary Gynecology and Obstetrics, College of Veterinary and Animal Sciences, Himachal Pradesh Agricultural University, Palampur, India. E-mail: madhumeet2004@rediffmail.com

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Summary

Overall, 531 dairy cows were inseminated with the aim to study their reproductive performance following administration of GnRH analogue on different days of estrous cycle with different doses. These cows were divided into six treatment and one control group. Depending upon different treatment groups, Buserelin acetate was injected at a dose of 10.5 µg or 21.0 µg on different days (0, 5 or 12) of estrous cycle in these cows. Control cows were inseminated without any treatment. Buserelin acetate improved conception in cows if administered either on day 0 along with AI or on Day 5 or 12 post insemination. The highest CR was recorded when 10.5 µg GnRH analogue was administered on day 12 post AI. The doses of 10.5 µg or 21.0 µg were equally effective when instituted on day 12 post AI.

Key words: GnRH, Dairy cows, Conception rate, Luteal phase

Introduction

Reproduction in dairy cows has drastically decreased during the last few decades due to many factors including inaccuracy of estrus detection, improper timing of insemination and ovulation problems. Another factor contributing to low pregnancy rates is embryonic loss. Along with many possible etiologies, low plasma progesterone concentration has been related to early embryonic death (Mann and Lamming, 1999).

Studies on the extent and timing of early embryonic mortality in the dairy cow indicate that though conception rates (CR) are close to 90 percent in normal cows (Roche *et al.*, 1981), early embryonic deaths during the first few weeks of pregnancy decrease the pregnancy rate to 60 percent (Diskin and Sreenan, 1980). At least 25 percent of embryos are lost during the first three weeks of pregnancy (Peters, 1996).

The reasons for this phenomenon are still poorly understood. Studies suggest the time at which the embryo enters the uterus to be critical, since embryo mortality has been found to occur by day 5 post-oestrus in the dairy cow (Wiebold, 1988).

A number of studies have been conducted examining the effect of GnRH on reproductive performances in dairy cows when administered on the day of AI (Shahneh *et al.*, 2008), early luteal phase (Beltran and Vasconcelos, 2008) and/or mid luteal phases (Szenci *et al.*, 2006).

The present experiment was planned with the aim to observe the effect of administration of GnRH analogue on different days of estrous cycle with different doses in dairy cows maintained under sub-temperate climate.

Materials and Methods

The work was conducted at the Clinical

Complex of the College of Veterinary Science, Palampur (32.6°N, 76.3°E, altitude 1290.8 m), India. Animals considered for clinical trials were in good health, normal cyclic with normal genitalia and no apparent clinical reproductive abnormalities.

In all, 531 normal cows were inseminated during this study. These cows were divided into six treatment and one control group. Depending upon the different treatments groups, Buserelin acetate, a GnRH analogue (Receptal, Intervet India Ltd.) was injected at the dose of 10.5 µg (2.5 ml) or 21.0 µg (5.0 ml) intramuscularly on different days (0, 5 or 12) of estrous cycle.

The animals included in the 10.5 µg dose (n=202) treatment group were subdivided into three groups viz. the Buserelin administration simultaneous to AI (day 0, group 1, n=65) or insemination and administration of Buserelin on day 5 (group 2, n=72) or 12 post AI (group 3, n=65). Similarly, the cows included in the 21.0 µg dose (n=238) treatment group were also subdivided into three groups, namely, the administration of the hormone simultaneous to AI (day 0, group 4, n=87), or insemination and administration of Buserelin on day 5 (group 5, n=79) or 12 post AI (group 6, n=72). Another 91 cows were selected as control and inseminated in standing heat without any treatment (group 7). Cows were inseminated with frozen thawed semen of Jersey X local hill cattle crossbred bulls. Pregnancy diagnosis was carried out 60 days post AI by rectal palpation method in cows that did not return to estrus within this duration and CR was calculated.

The data obtained were analysed through

Chi-square test using SAS statistical package version 9.2.

Results

Effect of administration of Buserelin acetate on different days of estrous cycle on conception in normal dairy cows has been shown in Table 1.

Buserelin acetate improved conception in cows if administered either on day 0 along with AI or on day 12 post insemination (P<0.05). The highest CR were recorded when 10.5 µg GnRH analogue was administered on day 12 post AI (P<0.05). The doses of 10.5 or 21.0 µg were equally effective when administered on day 12 post AI.

Discussion

These results are in agreement with the finding that the use of GnRH at the time of AI increases CR in dairy cows (Shahneh *et al.*, 2008). Contrarily, these findings differed from the observations of other researchers (Perry and Perry, 2009) who concluded that GnRH had no effect on CR if injected at the time of AI.

The improvement in fertility due to GnRH treatment in the present study has two possible explanations. Firstly, the positive effect of GnRH at the time of AI is mediated by the improved ovulation rate (Yaniz *et al.*, 2004). Cows treated with GnRH have a LH surge, which is maximum two hours after treatment (McDougall *et al.*, 1995) and causes a fourfold increase in plasma LH concentration after 2-2.5 h (Osawa *et al.*,

Table 1: Effect of administration of different doses of Buserelin acetate on different days of estrous cycle on conception in normal dairy cows

Treatment groups	Day of administration (post AI)	Cows inseminated	Pregnant	CR (%)
Buserelin acetate 10.5 µg (n=202)	0	65	36	55.38 ^{ab}
	5	72	42	58.34 ^{ab}
	12	65	44	67.69 ^b
Buserelin acetate 21.0 µg (n=238)	0	87	59	67.82 ^b
	5	79	45	56.96 ^{ab}
	12	72	47	65.27 ^b
Control (n=91)		91	45	49.45 ^a

Values with different superscripts differ significantly (P<0.05)

1995). Since the preovulatory surge of LH normally occurs about 6 h after onset of estrus (Schams *et al.*, 1977), treatment with GnRH at insemination may have induced a secondary surge of LH before or after the spontaneous preovulatory surge of LH. That added increment of LH may be beneficial to the events associated with conception.

Secondly, progesterone is a vital hormone during early pregnancy that promotes embryo development and controls the luteolytic mechanism (Mann and Lamming, 1999). A single GnRH dose at AI can increase subsequent plasma progesterone concentration (Kaim *et al.*, 2003) which is related to hypertrophy and hyperplasia of the luteal cells. GnRH injection at the time of estrus causes LH surge and following ovulation LH increases blood flow to ovaries, causing ovarian hyperemia. Therefore, CL formation occurs rapidly and progesterone production increases significantly (Rosenberg *et al.*, 2003).

The results of the present study in which the use of GnRH during the luteal phase (early/mid) enhanced the CR in the dairy cows are also in agreement with the earlier findings (Beltran and Vasconcelos, 2008). However, other researchers observed that GnRH did not improve conception in dairy cows (Szenci *et al.*, 2006; Khoramian *et al.*, 2011).

The improvement in the CR with the use of GnRH during luteal phase has been attributed to the fact that GnRH on day 5 induces ovulation of the first wave dominant follicle, thus forming an accessory CL and enhancing progesterone production early in the cycle. This increase in progesterone secretion caused by GnRH may facilitate embryonic development (Mann and Lamming, 1999). Similarly, administration of GnRH on day 12 is similar in nature to early administration of GnRH for enhancing progesterone production but is also timed to coincide with the critical period of maternal recognition of pregnancy and prior to the initiation of luteolytic mechanism characterized by the embryonic secretion of anti-luteolytic factors (Mann and Lamming, 2001). Exogenous administration of GnRH could initiate the endogenous increase in progesterone (Mehni *et al.*, 2012) via

increasing numbers and sizes of CLs following luteal phase administration of GnRH (Willard *et al.*, 2003). This increase in CL number and thus total CL tissue area is most likely responsible for the increased serum concentration of progesterone observed with GnRH treatment.

The results indicated that GnRH could be used on day 0 along with AI or on Day 5 or 12 post insemination in cows reared in the sub-temperate zone of India to increase the CR.

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