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PJBS

ISSN 1028-8880

Pakistan Journal of Biological Sciences

ANSInet
Asian Network for Scientific Information
308 Lasani Town, Sargodha Road, Faisalabad - Pakistan

Pakistan Journal of Biological Sciences 10 (14): 2402-2406, 2007
ISSN 1028-8880

Maintenance of Pregnancy in Repeat Breeder Dairy Cows by CIDR Administration After Breeding

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Abstract: The aim of this study was to assess the effect of two periods of P_4 therapy by CIDR on the 1st service Conception Rate (CR) of repeat breeder dairy cows. The cows were selected on the following basis: absence of dystocia, retained placenta and endometritis after the last parturition. They were inseminated according to the AM/PM rule relative to estrus onset and randomly assigned into 3 groups: (A) CIDR on day 5 after insemination that was removed on day 9 of the cycle (n = 40); (B) CIDR on day 5 after insemination that was removed on day 19 of the cycle (n = 36) and (C) untreated controls (n = 40). Pregnancy diagnosis was conducted by rectal palpation 45-55 days after AI in cows not observed in estrus. The difference in CR among the groups was analyzed by chi square analysis. The CR in groups A, B and C was 55, 41.7 and 30%, respectively and was greater ($p<0.05$) in treatment (A) cows than in control cows. In conclusion, repeat breeder cows in groups A and B benefited from progesterone supplementation, but significant effects of treatment for improvement of conception rate was seen in short treatment period (4 days treatment).

Key words: Cow, repeat breeding, CIDR, pregnancy rate

INTRODUCTION

Repeat Breeding (RB) is one of the major problems that affect the reproductive efficiency and economy of milk production in dairy animals. So far, the etiopathogenesis of this pathology has not been defined completely.

Cows that do not become pregnant by the third breeding are commonly referred to as repeat breeder cows. Repeat breeding is a syndrome for which several factors have been identified as its causes. One of the factors that contribute to repeat breeding in dairy cows is embryonic mortality; luteal insufficiency is a known cause of it. Progesterone (P_4) released from corpus luteum around day four after ovulation, stimulates IFN tau secretion that is the main factor that prevents luteolysis and maintains pregnancy. It is reported that stress is a cause of impaired reproductive efficiency. Stress may be involved in the inadequate luteal function in RB in which the stress factors (free radicals and beta-endorphins) may actually enhance each other and induce an inhibition of progesterone synthesis in repeat breeders (Dobson *et al*., 2001).

Several studies have shown that supplementing ovariectomized cows with exogenous progesterone maintained their pregnancies (Ayalon, 1978; Hawk *et al*., 1963; Zimbelman and Smith, 1966). A slower than normal rise in progesterone concentration and a lower total progesterone concentration have been measured in low-fertility cows and repeat breeder heifers in the first 6 days after estrus (Bage *et al*., 2002; Shelton *et al*., 1990). On the basis of an apparent benefit of early post-insemination progesterone supplementation and observation of higher circulating progesterone concentration in fertile cows during early diestrus, we thought that supporting the pregnancy up to the time of maternal recognition by providing supplemental progesterone in a sustained release mode, might increase pregnancy rate in repeat-breeder cows.

Studies in which P_4 has been administered in an attempt to improve pregnancy rates have yielded variable results. In most of these studies, P_4 supplementation initiated at the time of postovulatory rise (between days 4 and 5) has resulted in consistent increase in pregnancy rate (Mann *et al*., 2006). However, there is some discrepancy in the results of some studies in which the duration of P_4 supplementation were different. In a study reported by Villarroela *et al*. (2004), the repeat breeder cows have not benefited from P_4 supplementation from days 5 to 19 after AI. There is not any report which

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compare the effect of two periods of P_4 supplementation (short and long days) on conception of repeat breeder cows and also consider the lactation number and stage of lactation.

The aim of this study was to assess the effects of two periods of P_4 therapy by CIDR on the 1st service Conception Rate (CR) of repeat breeder dairy cows.

MATERIALS AND METHODS

The study was conducted on 1100-Holstein dairy cows in the central part of Iran from January 22, 2005 to June 6, 2005. Cows included in the study were in their first to fifth lactation, producing >20 kg milk per day. They had three to six unsuccessful inseminations within current lactation (repeat breeders) and had no disorders such as dystocia, retained placenta, primary metritis, ketonria and endometritis after the last parturition. They had not any touchable disorders in their reproductive tracts too. The BCS of the cows was 2.5-3.5. Cows with clinical conditions detected during the course of the study, such as mastitis, lameness, digestive disorders, abnormal genital discharges and pathological abnormalities of the reproductive tract detectable on palpation per rectum, were also withdrawn from the program.

The cows inseminated at the suitable time after observation standing estrus and entered the study on day 5 after AI. They randomly assigned in one of the following 3 groups: Group A: cows that received a modified progesterone releasing intravaginal device (CIDR, Inter Ag. Hamilton, New Zealand, containing 1.9 g of P_4). This device is designed to allow for sustained release of P_4 for around 14 days. It was inserted on day 5 after AI and removed on day 9 (treatment period = 4 days, AI = day 0).

Group B: cows that received a CIDR between days 5-19 after AI (treatment period = 14 days, AI = day 0). Group C: these cows received no treatment and considered as control group.

All cows were observed daily for estrus. Percentage of pregnancy in each group recorded 45-55 days after latest AI by rectal palpation. The difference in CR among the groups was analyzed by chi square analysis.

RESULTS

As shown in Fig. 1, treatment increased conception rate in groups A and B comparison with group C in the treatment cycle but this difference statistically was only significant between group A and C ($p<0.05$).

Cows were evenly distributed among the 3 groups according to parity, milk production and Days In Milk (DIM) Table 1.

Table 1: Distribution of cows by studying variables and outcome (n = 116) for evaluation of the effect of progesterone supplementation in repeat breeder Holstein dairy cows after insemination at the treatment cycle

Variables	Level	No. of cows in group A	No. of cows in group B	No. of cows in group C
Lactation No.	1	13	9	12
	2	7	9	10
	+3	20	18	18
Milk production (kg)	20.0-29.2	10	7	6
	29.3-34.5	5	11	12
	34.6-54.2	25	18	22
Days in milk	126-185	19	13	14
	186-407	21	23	26
Out come	Pregnant	22	15	12
	Open	18	21	28
Total No. of cows		40	36	40

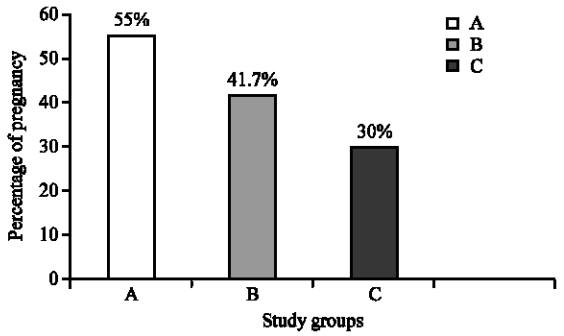

Fig. 1: Comparison of conception rate in study groups in the treatment cycle. Difference in conception rate between groups A and C is statistically significant ($p<0.05$)

DISCUSSION

The objective of this study was to determine whether supplemental progesterone would increase proportion of inseminated repeat breeder cows diagnosed pregnant 45-55 days after latest AI in the treatment cycle in two different treatment periods. Many repeat breeder cows are not kept long enough to produce three or more lactation because they will have long calving intervals and reduced daily production.

In this study repeat breeder cows received supplemental P_4 in two different periods after AI (days 5-9 and 5-19) compared to other studies where cows were treated for approximately one week beginning at various post-insemination times (Johnson *et al*., 1958; Robinson *et al*., 1989; Stevenson and Mee, 1991).

Another difference between our study and some other studies is the criteria for selecting repeat breeder cows. In our study cows selected on the basis of some criteria including: without dystocia, retained placenta and endometritis after the last parturition and also they had

not any touchable disorders in their reproductive tracts. In this study conception rate in groups A and B is higher than group C at the treatment cycle but only difference between A and C groups is statistically significant ($p<0.05$). This study as many other previous studies suggests that ovulation and conception apparently occur in some repeat breeder cows ultimately diagnosed as non-pregnant and that at least some of these pregnancy losses can be prevented by P_4 supplementation from days 5-9 post-insemination.

The corpus luteum which produces significant concentrations of circulating progesterone by approximately 4-days post-ovulation has an essential role in pregnancy maintenance. The intention for 5-9 treatment period were to prevent a too-slow rise in progesterone concentrations during the first week after insemination (Bage *et al*., 2002; Helmer and Britt, 1986; Shelton *et al*., 1990) enhance embryo growth (Garrett *et al*., 1988) IFN-tau secretion (Binelli *et al*., 2001; Kerbler *et al*., 1997; Thatcher *et al*., 2001) and stimulating uteri secretions that are essential for embryonic growth (Kerbler *et al*., 1997; Morrow, 1986; Robinson *et al*., 1989). The intentions for 5-19 treatment periods beside of above points were to cover the critical period (days 15-17 cycle) of early pregnancy and to ensure P_4 concentrations until the time of tenuous attachment of the chorion to the endometrium (Villarroel *et al*., 2004). Previous studies showed that non-ovariectomized cows supplemented with exogenous P_4 early in the post-insemination with different treatment periods had higher pregnancy rate than control cows (Johnson *et al*., 1958; Macmillan *et al*., 1991; Mann and Lamming, 1999; Robinson *et al*., 1989). In one study done by Robinson *et al*. (1989), dairy cows supplemented with exogenous progesterone for 7 days in two groups (days 5-12 and days 10-17 post-insemination). They showed that treatment in both treatment groups significantly improved pregnancy rates comparing to control group, regardless that secretion of endogenous P_4 suppressed in 10-17 treatment period but not in days from 5-12 post-insemination (Robinson *et al*., 1989).

Although in this study endogenous progesterone secretion did not assess, but by attention to the results from one similar study which was reported by Robinson *et al*. (1989), we can imagine that endogenous P_4 secretion has suppressed in group B but not in group A. They reported that endogenous P_4 secretion from CL is stimulated by LH secreted from the pituitary, so high levels of circulating exogenous P_4 due to CIDR may suppress LH secretion which consequently can influence the endogenous P_4 secretion. Treatment increased conception rate in both A and B groups. Explanations for this result including: a) Elevation of P_4 concentrations above a minimal threshold necessary to maintain pregnancy and therefore treating a true P_4 deficiency (Starbuck *et al*., 1999). b) Overcoming possible P_4 receptor insensitivity (Moudgil *et al*., 1989) so that higher concentrations of P_4 than normal are needed to maintain pregnancy. c) A collateral pharmacologic effect of immunosuppression (Hansen, 1998) in repeat breeder cows that perhaps have been hyperstimulated by a number of inseminations and are reacting against their embryos. d) Increasing uteri EGF secretion, because this biologic matter has an important role to stimulating embryo growth and CL activity (Ktagiri and Takahashi, 2004). e) Stimulating atresia in a large follicle that may be on the ovary in early pregnancy that has an adverse effect on pregnancy maintain because of estradiol secretion (Cavalieri *et al*., 1998; Colazo *et al*., 2004; Pritchard *et al*., 1994). f) Increasing endometrial gland secretions and affecting uteri amino acid secretion patterns, because amount of total protein that secreting from uteri in repeat breeder cows is lower than normal cows (Morrow, 1986; Roberts, 1986). Explanations for this point that why treatment only between A and C groups created significant difference including: a) In the cows of group B, CIDR for a period of 14 days resulted in suppression of endogenous P_4 secretion (Mann and Lamming, 1999). After CIDR removal, the renewing of endogenous P_4 levels by CL response to increasing LH takes time which a gap of low P_4 can threat the pregnancy maintenance. b) Maybe in some of the cows in group B the decreasing amount of plasma P_4 levels a little time after CIDR removal, creating a hormonal situation similarly to the late estrus cycle in the cyclic cows. In this situation, due to decreasing plasma P_4 levels, uteri oxytocin receptors increasing and banding with oxytocin that secreting from CL which consequently stimulate uteri $PGF_{2\alpha}$ secretion. Finally with increasing uteri $PGF_{2\alpha}$ secretion and CL degeneration, early embryonic death occurs and new estrus cycle will begin (Arnold *et al*., 2000; Binelli *et al*., 2001).

In the present study conception rate among the lactation numbers, different stages of lactation and DIM in each study group and among 3 groups was not significant (Table 1).

In one study that PRID used in repeat breeder dairy cows for days 5-19 post-insemination, only significant difference between PRID group and control group was in first and second parity cows in late stage of lactation (Villarroel *et al*., 2004).

The result of a study reported by Mann *et al.* (2006) may explain the significant effect of P_4 supplementation in Group A of our study. They were reported that P_4 supplementation during the postovulatory rise, but not later in the luteal phase, increased embryo development and IFN tau production.

In conclusion, repeat breeder cows in groups A and B benefited from progesterone supplementation, but significant effects of treatment for improvement of conception rate was seen in short treatment period (4 days treatment). So, short period of P_4 supplementation is recommended for repeat breeder dairy cows who suspected to suffer from hormonal imbalance (low P_4) at the early stage of pregnancy. Its economical aspect is also obvious which each CIDR can be used for 2 cows.

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