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Effect of subluteal dose of prostaglandin $F_2\alpha$ administration during artificial insemination on fertility rate in cows

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Abstract
The study was conducted in postpartum cows which were brought for artificial insemination during natural estrum. A total of 40 calved animals were used in this study. One ml of prostaglandin $F_2\alpha$ (5 mg) were mixed along with 39 ml of distilled water to make 125 µg of prostaglandin $F_2\alpha$ (subluteal dose) per ml and injected through ear vein at the time of artificial insemination (AI). The control cows were inseminated without any treatment. Transrectal ultrasonographic study of the ovary was done to study follicular status before inseminating the cows. Ovulatory response in treatment and control were monitored by ultrasonography on day 10 post AI. The pregnancy was confirmed 60 days after insemination in both the groups. Follicular size at the time of the AI was similar (12.91±0.14 mm and 12.80±0.17 mm) between experimental and control groups and the time of ovulation between experimental and control group was17.93 ±0.63 and 24.25±1.20 hrs, respectively. Conception rate was 70.00% in experimental and 40.00% in control groups.

Keywords: estrum, prostaglandin $F_2\alpha$, sub luteal, transrectal, ovulation

Introduction
The luteolytic effects of prostaglandin F2α (PGF2α) and its analogues during the dioestrus period of the oestrous cycle are well documented, and PGF2α has been used widely in the synchronisation protocol [2]. Prostaglandins are 20 carbon atom molecules which are involved in LH-induced progesterone synthesis and have a role in luteolysis. Further various research works in animals indicated that they may be closely linked with ovulation itself. This may be a local effect on the ovary, but there is some evidence that prostaglandins function as central neurotransmitters and influence the hypothalamic pituitary axis. Considerable evidence exists supporting a role for prostaglandins in the process of ovulation in the rat and rabbit and other species. Inhibition of prostaglandin synthesis by the systemic or local administration of indomethacin or aspirin has been shown to block ovulation in the rabbit and the rat [8] and [1]. Since this block could not be overcome by LH, but could be reversed by administration of exogenous prostaglandins, the prostaglandin involvement appeared to be at the ovarian level. Prostaglandins of the F (PGF) and E (PGE) series both increased in ovulated follicles, but not in follicles which failed to ovulate. With the above background information, the present study was conducted with the objective of identifying the role of prostaglandin $F_2\alpha$ ($PGF_2\alpha$) on the ovulation and conception rate in cows.

Material and Methods
The study was conducted in the dairy cows which are brought to the artificial insemination unit of Teaching Veterinary Clinical Complex (TVCC), Namakkal. A total of twenty calved cows were used for this study. In treatment groups (10 cows) One ml of prostaglandin $F_2\alpha$ (5 mg) were mixed along with 39 ml of distilled water to make 125 µg of prostaglandin $F_2\alpha$ (subluteal dose) per ml and injected through ear vein at the time of artificial insemination (AI). The control cows (10 cows) were inseminated at oestrum without any treatment. Transrectal ultrasonographic study of the ovary was done to study follicular status before inseminating the cows. Ovulatory response in treatment and control were monitored ultrasonographically on day 10 post AI. The pregnancy was confirmed 60 days after insemination in both the groups. The collected data was analyzed statistically [10].

Results and Discussion

In this study the size of the follicle, time of ovulation, size of corpus luteum and conception rate are presented in Table 1.

Size of the follicle

The mean±SE dominant follicle size at the time of artificial insemination was 12.91±0.14 and 11.80±0.17 mm in the pregnant cows and 13.18±0.62 and 11.98±0.23 mm in the non-pregnant cows of experimental and control groups, respectively. In general, the size of the dominant follicle at the time of artificial insemination was larger in non-pregnant cows than the pregnant cows. There was no significant ($P \geq 0.05$) difference was observed between these groups and also between pregnant and non-pregnant cows in the follicular size at the time of insemination. The result of the present study was concurred with the results of [6] and [4]. Ovulatory follicle size of 12.80±1.60 and 13.20±1.80 mm in two different groups of cows [6] whereas the follicular size of 13.00±1.80 mm in cows was reported [5]. The cows with ovulatory follicular size of 13-15 mm had higher pregnancy rate than other categories of follicle [4].

Time of ovulation

The mean±SE time interval between subluteal $PGF_2\alpha$ injection (and insemination) and ovulation was 17.93±0.63 and 17.67±1.10 hours in the pregnant and non-pregnant cows of experimental group and the interval between insemination and ovulation was 24.25±1.20 and 26.00±2.68 hours in the pregnant and non-pregnant cows of control group. There was a significant ($P \leq 0.05$) difference was observed between experimental and control group in the ovulation time in both pregnant and non-pregnant cows. During the pre-ovulatory period there was an increase in the follicular prostaglandin level and it could increase up to 60 fold as the ovulation approaches [9]. As the prostaglandin level increases the cascade of proteolytic enzymes including plasminogen activator, plasmin and matrix mettallo proteinases which bring about degradation of follicular matrix and decomposition of the meshwork of collagen fibers of follicular wall [7]. Along with these, the follicular wall contraction caused by prostaglandins led to ovulation [3]. In the present study it was observed that ovulation occurred earlier in the experimental group than the control group which clearly indicates that the prostaglandin has a definite role in the process of ovulation.

Size of corpus luteum

The mean±SE diameter of the corpus luteum after 10 days of artificial insemination was studied using ultrasonography in both the groups. The size of the corpus luteum was 23.76±0.21 and 23.10±0.33 in the pregnant cows and 23.30±0.76 and 23.13±0.24 in the non-pregnant cows of experimental and control group, respectively. Even though the size of the corpus luteum size had no significant ($P \geq 0.05$) difference between the two groups and also between pregnant and non-pregnant cows, the overall size was slightly larger in the pregnant cows than the non-pregnant cows.

Conception rate

The overall conception rate was higher in the experimental (70 per cent) group than the control (40 per cent) group which differed highly significant between the two groups. The luteal progesterone after artificial insemination was essential for the appropriate establishment and maintenance of pregnancy and the size of the follicle determines the size of the corpus luteum but at the same time larger the size of the ovulatory follicle (above 15 mm) led to reduced pregnancy rate [4].

Conclusions

In this research we conclude that higher pregnancy rate obtained in experimental group might be due to the optimum size of the ovulatory follicle, earlier ovulation and more viable spermatozoa at the time of ovulation.

Table 1: Mean (±SE) follicular size, ovulation time, size of corpus luteum and conception rate in the experimental and control cows

Parameters		Experimental group (n=10)	Control group (n=10)
Size of the follicle (mm)	Pregnant	12.91±0.14	12.80±0.17
	Non pregnant	13.18±0.62	11.98±0.23
Ovulation time (hrs)	Pregnant	17.93^a ±0.63	24.25^b±1.20
	Non pregnant	17.67^a ±1.10	26.00^b±2.68
Size of corpus luteum (mm)	Pregnant	23.76 ± 0.21	23.10±0.33
	Non pregnant	23.30 ± 0.76	23.13±0.24
Conception rate (%)		70^a	40^b

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