

EFFECT OF PROSTAGLANDIN ANALOGUE ADMINISTERED USING TWO DIFFERENT ROUTES ON THE INCIDENCE OF ESTRUS AND SUPEROVULATORY RESPONSE OF FRIESIAN COWS

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SUMMARY

A total of 16 cows have been used in two experiments in this study. In the first experiment, eight cows were divided into two groups. Group A received 2 ml Estrumate (500 µg cloprostenol) intra-muscular, while group B received 1 ml Estrumate (250 µg cloprostenol) intra-vulvular. In the second experiment, eight cows were divided into two groups. Group C received 5 ml lutalyse (25 mg dinoprost, tromethamin) intramuscularly, while group D received 2.5 ml lutalyse (12.5 mg Dinoprost, tromethamin) intra-vulvular. The treatments were carried out on day 10 of the previous estrus. Blood samples were obtained from cows for progesterone determination. Cows were superovulated with 2500 I.U. pregnant mare serum gonadotrophin (PMSG) on day 10 of the estrous cycle.

In both experiments it was found that the interval from treatment to onset of estrus was significantly ($P < 0.001$) shorter in groups B and D compared with groups A and C, respectively. In both experiments it was found that the concentration of serum progesterone ($\bar{X} \pm S.E$ ng/ml) in groups B and D was significantly higher ($P > 0.001$) than in groups A and C. Number of corpora lutea, embryos recovered, recovery rate % and embryos considered viable were higher in groups B and D compared with groups A and C but the differences were not significant. The number of unfertilized ova were lower in groups B and D than groups A and C but the differences were not significant.

It is concluded from the present study that half dose of prostaglandin intra-vulvular can improve superovulation in dairy cows and decrease the time to onset of estrus.

Keywords: Friesian cows, prostaglandin, estrus, superovulatory response.

INTRODUCTION

Estrous synchronization is one of the most effective methods developed for increasing reproductive performance in cattle. Regulation of the estrous cycle and control of ovulation using prostaglandin would allow dairy farmers to eliminate estrous detection and to utilize fixed-time for insemination. Estrous synchronization,

in planned breeding programs, can increase the effectiveness of A.I. and can overcome the difficulties in estrous detection. Furthermore, it is essential for embryo transfer techniques. Treatment with PGF₂α induced luteolysis within 24 hours in cattle (Louis *et al.*, 1973; Schallenberger *et al.*, 1984), and this mechanism has been incorporated into numerous procedures to successfully synchronize estrus. Fertility following PGF₂α induced estrus synchronization is comparable to that in spontaneously cyclic animals, provided insemination occurs at the proper time relative to the onset of estrus (Roche, 1976). However, variation in the interval to return to estrus reduces the conception rate following single fixed-time insemination (Macmillan and Day, 1982 and Momont, 1985). Injection of prostaglandin F₂ alpha or one of its analogues, at any time between day 5 and 10 of the bovine estrous cycle, will result in luteal regression with a consequent return to estrus within 2 - 3 days (Roche, 1974 and Rowson *et al.*, 1972).

There is evidence to suggest that intra-muscular injection of 25 mg PGF₂α usually recommended to synchronize estrus, is higher than the one needed to cause luteolysis in cows (Garcia-Winder and Gallegos-Sanchez, 1991).

The present study was conducted to investigate effect of PGF₂α analogue when half dose was administered intra-vulvular on the interval from treatment to onset of estrus and superovulatory response of Friesian cows.

MATERIALS AND METHODS

This current work was conducted at Karada Animal Experimental Station, Animal Production Research Institute. A total of 16 lactating cows was used in two experiments. Cows aged 2.5 to 7.6 years and calved at least 3 months prior to the treatments. Animals were randomly divided into two equal experimental groups according to age, weight and parity.

In the first experiment, eight cows were divided into two equal groups (A and B). Cows in group A were treated with 2 ml Estrumate (500 µg cloprostenol) intramuscularly while cows in group B were treated with 1 ml Estrumate (250 µg cloprostenol) intra-vulvular.

In the second experiment, eight cows were divided into two equal groups (group C and group D). Cows in group C were treated with 5 ml lutalyse (25 mg dinoprost, tromethamin) intramuscularly, while cows in group D were injected with 2.5 ml lutalyse (12.5 mg dinoprost, tromethamin) intra-vulvular.

The treatments were carried on day 10 of the previous estrus. At the time of the treatment both ovaries were palpated via rectum, and animals which did not show a well developed corpus luteum were discarded. Estrus was observed three times daily (8.00 a.m., 12.00 noon and 4.00 p.m.).

In both experiments, cows were superovulated with 2500 I.U. pregnant mare serum gonadotrophin (PMSG) intramuscularly on the 10th day of the synchronized estrous cycle. At 48 hours after PMSG injection, the cows were administered with prostaglandin analogue intramuscularly (im) in group A and C or intravulvularly (iv) in group B and D, respectively. All animals were artificially inseminated three times

throughout estrus at 8-12 hr intervals beginning at 48 hr after PG injection using frozen semen. On day 7 after the first AI, embryos were collected nonsurgically after assessment of ovarian size, number of corpora lutea and unovulated follicles by rectal palpation of the ovaries. Cow was considered responding to superovulation when two CL or more were found. Jugular blood samples were obtained from cows before treatment and every day for a further 21 days and serum progesterone levels were measured using solid phase coated 125 I radio immunoassay kits. Statistical analysis was carried out according to Steel and Torrie (1960).

RESULTS AND DISCUSSION

Table 1 shows that the interval from intra-muscular treatment with estrumate or lutalyse to the onset of estrus was longer than intra-vulvular treatment (22.00hr.). The differences between the two routes of injections were statistically significant ($P < 0.01$). The average numbers of corpora lutea induced using estrumate or lutalyse intra-vulvular were higher than using these analogues intra-muscularly, however such difference was statistically not significant. The average number of embryos collected using estrumate was more than using lutalyse intra-muscular or intra-vulvular. Intra-vulvular injection of estrumate or lutalyse produced insignificant more embryos than intra-muscular injection. So the average number of viable embryos was higher in groups of cows which were treated with estrumate or lutalyse intra-vulvular than intra-muscular. The difference between the two groups was statistically not significant.

Table 1. The incidence of estrus and superovulation response after treatment with prostaglandin analogue (estrumate or lutalyse) injected intra-muscular or intra-vulvular in cows.

Criteria	Treatment Groups			
	A	B	C	D
Interval from PG treatment to onset of estrus (hr).	71.30±0.69	48.75±0.6**	72.63±0.51	50.13±0.38**
No of corpora lutea.	6.00±0.71	7.00±0.71	5.25±0.48	6.5±0.65
No of embryos recovered.	3.25±0.69	4.30±0.69	2.75±0.48	3.25±0.63
No of unfertilized ova.	0.50±0.27	0.30±0.27	2.25±0.15	0.50±0.29
Recovery rate %.	63.25±5.01	63.50±5.01	55.83±6.58	56.58±5.85
No of viable embryos	2.50±0.25	3.80±0.41	2.25±0.48	2.75±0.48

** Significant at $P < 0.01$

Progesterone concentration in blood serum of cows treated with estrumate or lutalyse during the first six days post administration is presented in Table 2. It was observed that the overall mean of serum progesterone concentration in cows which were injected with estrumate or lutalyse intra-vulvular was significantly higher ($P < 0.01$) than in cows which were injected intra-muscular (2.50 vs 2.14 ng/ml). The rate of decrease in blood progesterone concentration in the first day after treatment was 31.4, 51, 32.3 and 49.5% in group A, B, C and D, respectively. The responses to $PGF_{2\alpha}$ were affected by the routes of administration in both experiments. The

effectiveness was pronounced when PGF₂α analogue was administrated intra-vulvular than intra-muscular administration, despite the dose used intra-vulvular was half as the intra-muscular injection. This difference in response to PGF₂α may be associated with the difference in site of administration, because intra-vulvular had more local effectiveness in genital tract, mainly on ovaries as compared to the intra-muscular injection.

Table 2 .Blood serum progesterone (ng/ml) in cows treated with prostaglandin analogue (estrumate or lutalyse) intra-muscular or intra- vulvular.

Days after injection	Estrumate		Lutalyse	
	Intra-muscular	Intra-vulvular	Intra-muscular	Intra-vulvular
0	4.52±0.11	4.92±0.04	4.13±0.09	4.55±0.14
1	3.10±0.16	2.41±0.04	2.80±0.09	2.30±0.11
2	1.95±0.16	0.49±0.04	1.85±0.22	0.56±0.04
3	0.57±0.06	1.60±0.09	0.58±0.05	1.25±0.08
4	1.25±0.06	2.21±0.07	1.11±0.04	2.08±0.08
5	2.03±0.10	3.14±0.19	1.86±0.11	3.02±0.16
6	2.20±0.08	3.29±0.08	2.01±0.10	3.10±0.19
Mean + S.E	2.23 + 0.48	2.58 +0.52	2.05 +0.43	2.40 + 0.49

It was observed in both experiments as shown in Table 3 and Figure 1 that administration of PMSG caused a pronounce increase in serum progesterone. The rate of increase in blood progesterone concentration in the second day after PMSG injection was 4.33 ng/ml (89.3%) and 4.29 ng/ml (96.6%) in group A and B and it was 4.08 ng/ml (87.4%) and 4.00 ng/ml (97.3%) in group C and D using intra-vulvular and intra-muscular treatment respectively over the value before treatment. Such increase in progesterone level after PMSG treatment was also observed by Saumande (1980) and Kweon *et al.* (1987) and this was probably due to LH activity. In experiment 1 and 2 progesterone concentration reached the maximum value on the day of Flushing. The present results revealed that there was significant correlation between progesterone concentration and number of corpora lutea (P<0.01) in both experiments. These results are partially in agreement with Goto *et al.* (1987) who found a significant correlation between serum progesterone concentration and number of corpora lutea on the flushing day. The present study revealed that there was no significant differences in superovulation response and progesterone concentration using estrumate or lutalyse.

Results from the present study showed that we can use half of intra-muscular prostaglandin analogue dose (estrumate or lutalyse) by intra-vulvular injection to improve superovulatory response and decrease the time to synchronization at low cost. These results are in agreement with Garica, Winder *et al.* (1991).

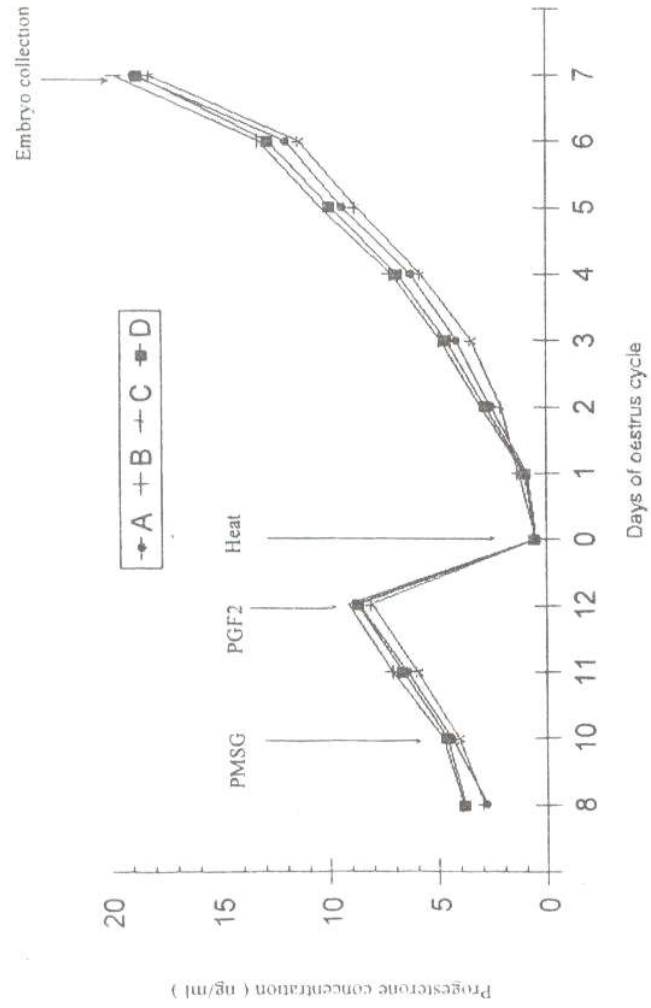


Figure 1: Progesterone concentration in blood serum of cows superovulated with PMSG and treated with Estrumate or Lutalyse intra-muscular or intra-vulvular.

Table 3. Average progesterone concentration ($\bar{x} \pm S.E$ ng/ml) in blood serum of cows superovulated with PMSG and treated with estrumate or lutalyse intra-muscular or intra-vulvular.

Day of estrous cycle	Estrumate		Lutalys	
	Intra-muscular	Intra-vulvular	Intra-muscular	Intra-vulvular
8 Before PMSG inj.	2.86±0.29	3.95±0.20	2.98±0.5	3.83±0.16
10 PMSG inj.	4.44±0.06	4.85±0.29	4.11±0.07	4.67±0.25
12 PGF _{2α}	8.73±0.33	9.18±0.54	8.11±0.35	8.75±0.59
0 Day of estrus	0.55±0.07	0.54±0.03	0.51±0.04	0.61±0.06
7 Day of embryo collection	18.93±0.70	19.85±0.42	18.21±0.7	18.78±0.36

REFERENCES

- Garcia-Winder, M.J. and J. Gallegos-Sanchez, 1991. Oestrus synchronization in Holstein cows using reduced doses of prostaglandin F_{2α}. *Theriogen.*, 36: 191.
- Goto, K., Y. Ohkustu, S. Nakanishi, K. Ogwa, M. Tasaki, H.Ohta, S. Inohae, S.Tateyama, T. Kawabata, S. Ishii, A. Miyamoto, T. Furusawa, M. Umezu and J. Masaki, 1987. Endocrine profiles and embryo quality in superovulated Japanese black cattle. *Theriogenology*, 29: 615.
- Kweon, O.K., H. Kanagawa, Y. Takahashi, A. Miyamoto, J. Masaki, M. Umezi, S.K. Agabu, Y. Twazumi and Y. Aoyagi, 1987. Plasma endocrine profiles and total cholesterol levels in superovulated cows. *Theriogenology* 27: 841.
- Louis, T.M., H.D. Hafsand, B.E. Seguin, 1973. Progesterone, L.H., estrus and ovulation after prostaglandin F_{2α} in heifers. *Proc. Soc. Exp. Biol. Med.* 143: 152.
- Macmillan K.L. and A.M. Day, 1982. Prostaglandin F_{2α} - Fertility drug in dairy cattle. *Theriogenology* 18: 245 abstr.
- Momont, H.W., 1985. Reproductive response factors of dairy cattle treated with cloprostenol. Ph.D. Dissertation University of Minnesota.
- Roche, J.F., 1974. Synchronization of oestrus and fertility following artificial insemination in heifers given prostaglandin F_{2α}. *J. Reprod. Fert.*, 37: 135.
- Roche, J. F., 1976. Fertility in cows after treatment with prostaglandin analogue with or without progesterone. *J. Reprod. Fert.* 46: 341 - 345.
- Rowson, L.E., A. R. Tevit and A. Brand, 1972. The use of prostaglandins for synchronization of oestrus in cattle. *J. Reprod. Fert.*, 29: 145.
- Saumande, J., 1980. Concentrations of luteinizing hormone, oestradiol-17β and progesterone in the plasma of heifers treated to induce superovulation. *J. Endocr.*, 84: 425.
- Schallenberger, E., D. Schams, B. Bulerman and D.L. Walters, 1984. Pulsatile secretion of gonadotrophins, ovarian steroids and ovarian oxytocin during prostaglandin-induced regression of the corpus luteum in the cow. *J. Rep. Fert.* 74: 493 - 501.
- Steel, R.G. D. and J.H. Tome, 1960. Principles and procedure of statistics. McGraw Hill BK. Komp., N.Y

تأثير استخدام البروستاجلاندين بطريقتين مختلفتين على احداث الشياح وعلى مدى استجابة المبايض لعملية تعدد التبويض فى الأبقار الفريزيان.

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فى هذا البحث تم استخدام ١٦ بقرة فريزيان فى تجربتين لدراسة تأثير استخدام البروستاجلاندين اما بالحقن فى العضل او بالحقن فى احدى الشفرتين على طول الفتره من الحقن حتى حدوث الشياح وعلى تركيز هرمون البروجسترون فى السيرم وكذلك على مدى استجابة المبايض لعملية تعدد التبويض ممثله فى عدد الأجسام الصفراء وعدد الأجنة المتحصل عليها وعدد البويضات الغير مخصبه وعلى عدد الأجنة الصالحة للزرع .

التجريبه الأولى : كانت مكونه من مجموعتين كل مجموعه ٤ بقرات المجموعه الأولى تم حقنها بـ ٢ ملليمتر من مادة الإسترومات فى العضل (تحتوى على ٥٠٠ ميكروجرام كلوبرستينول). المجموعه الثانيه تم حقنها بـ ١ ملليمتر استرومات فى احدى الشفرتين (تحتوى على ٢٥٠ ميكروجرام كلوبرستينول).

التجريبه الثانيه : كانت مكونه من مجموعتين كل مجموعه ٤ بقرات حقنت المجموعه الأولى فى العضل بخمسه ملليمتر من مادة الليوتيليز (تحتوى على ٢٥ ملليجرام دينوبروست - تروميثامين) . المجموعه الثانيه تم حقنها بـ ٢,٥ ملليمتر ليوتيليز (تحتوى على ١٢,٥ ملليجرام:دينوبروست - تروميثامين) تمت المعامله فى بداية كل تجريبه فى اليوم العاشر من الشياح السابق وتمت ملاحظه الشياح مرتين يوميا ثم اخذت عينات دم قبل المعامله مباشرة ثم يوميا لمدة ٢١ يوما متتاليه وذلك لقياس تركيز هرمون البروجيسترون فى السيرم . وقد تم حقن جميع الأبقار فى العضل بهرمون الجونادوتروفين المستخلص من دم الفرس الحامل بمعدل ٢٥٠٠ وحده دوليه للبقرة الواحده وذلك لإحداث عملية تعدد التبويض .

من النتائج فى التجريبتين نلاحظ ان الفتره هن المعامله بالبروستاجلاندين حتى حدوث الشياح كانت معنويا اقل فى المجموعه الثانيه عن المجموعه الأولى كذلك عدد البويضات الغير مخصبه كان اقل فى المجموعه الثانيه عن المجموعه الأولى - اما تركيز هرمون البروجسترون فقد كان فى المجموعه الثانيه اعلى من المجموعه الأولى وكان الفرق معنويا وفى التجريبتين ايضا قد وجد ان عدد الأجسام الصفراء وعدد الأجنة المتحصل عليها وكذلك عدد الأجنة الصالحة للنقل كان اعلى فى المجموعه الثانيه عن المجموعه الأولى.

لذلك اتضح ان استخدام نصف جرعة البروستاجلاندين المستخدمه فى العضل والحقن فى احدى الشفرتين يقلل المده اللازمه لإحداث الشياح وكذلك يحسن من استجابة المبايض لعملية تعدد التبويض هذا مع الإقتصاد فى التكاليف.