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ESTRUS SYNCHRONIZATION OF JERSY CATTLE UNDER ARID LAND ENVIRONMENT

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ABSTRACT

The objective of the present study was to evaluate the effect of using one method of estrus synchronization programs on Jersy cattle reproductive performance under arid land environment, by applying a specific doses of prostaglandin F2α (two injections of 5*ml* for cow), to increase the reproductive efficiency of the animals, through regulating time of pregnancy and parturition. Forty non-pregnant, healthy cows were taken randomly from the original stock of Hada Al Sham Research station which belong to king Abdul Aziz University and were classified into two groups, treatment and control groups. Results obtained showed that: estrus synchronization program using two injections of prostaglandin F2α showed that, statistically, there is no significant difference in the plasma progesterone concentration between treated and control groups. Jersy cows treated with prostaglandin F2α showed estrus in a shorter period compared to the control group. The percentage of animals showed estrus was 75 ٪ in treated group, compared with 65% in control group which showed 84 ٪. The pregnancy rate in treated group was 86.66 ٪, versus 69.23٪ in the control group. Service period length (SPL) was 97 days for the treatedgroup, compared to 104 days for the control group. There is a significant ($P \leq 0.01$) difference in the plasma progesterone concentration between both groups during pregnancy, which was higher in the treated group.

- The differences in the plasma progesterone concentration between both groups after parturition were not significant. Estrus synchronization in the Kingdom of Saudi Arabia under arid land environment was considered as an application of new technology to improve reproductive efficiency of animals, and to regulate time of breeding and parturition in the herd. This will lead to a great important in the management of the animal production branches.

INTRODUCTION

Synchronization of estrus or controlled breeding are terms to indicate the process of bringing groups of animals into heat together in response to some treatments. Such animals therefore conceive at closely similar times, and produce their offspring in a short period. The advantages of such scheme are managerial.

In fact the more recent approaches to estrus synchronization not only regulate but also enable the time of ovulation to be predicted, thereby permitting insemination at the optimum time possibly arranged several weeks in advance. Other advantages of synchronization include feeding in uniform groups with diets appropriate to their stage of pregnancy, supervising taking car of birth to reduce neonatal mortality and to arrange cross-fostering, scope for patch weaning fattening and marketing the animals and their products, and as a general management aid to rationalize the use of labors, building and other resources (**Diskin and Sreenan, 1994; Bo *et al* 1995; Geary *et al* 2000 and Lopez-Gatius 2000**).

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Many estrous periods in dairy cows are brief, and at least three times per day are required to detect most cows that exhibit estrus, (**Diskin and Sreenan, 1994**). A schedule of three observations per day is inconvenient, time consuming, and therefore, not often implemented. As a result, managing reproduction in dairy herds has been a long-standing problem. Approximately 50% of the estrous periods are not detected by the farmers (**Williamson *et al* 1972 and Stevenson *et al* 1996**), thus delaying conception and causing economic loss.

The objective of the present study was to evaluate the potential of a new method for synchronization of estrus under arid land environment, and to compare the reproductive performance of Jersy cows synchronized with those unsynchronized (control). A third objective was to assess the effects of this new method of estrus synchronization on plasma progesterone concentration and percentage of animals came in estrus (estrous response).

MATERIALS AND METHODS

Forty non-pregnant, healthy Jersy cows, in Hada Al Sham Research Station under arid land environment. Normal animals was selected randomly and divided into two experimental groups.

Group schedule

a- Group 1 (treated group)

Animals in this group was subjected to a treatment system using prostaglandins F2α -2 (Lutalyse). Two injections of prostaglandin were given 11 days apart (5ml for each administered intramuscularly). The first injection will interrupt the cycles of those cows with mature (more than 5 days old CL's). Any normally cycling cow that did not have a mature CL at the time of the first injection should have one by the time of the second injection (11 days later). Those cows that responded to the first injection will now have seven to eight days old CL's. Therefore, all cycling cows will be synchronized by the second injection. After 24 hrs from the second injection, animals was injected with a physiological dose of hCG (1500 IU). Finally, animals was bred naturally upon detection of heat with high fertile bulls.

b- Group 2 (Control group)

Animals in this group were subjected to a natural daily routine applied in the Farm, and inseminated naturally with high fertile bulls.

In both experimental groups, estrus was confirmed by rectal examination at the time of insemination in the cows of both groups. The animals were considered to be in estrus and ready for service when the corpus luteum was less than 10 mm in diameter, the largest follicle had a slack fluctuation and a diameter of 15 to 25 mm, the uterus showed very strong contractility and the external orifice of the cervix was open (**Grunert, 1979**).

Animal Management

The herd was under the veterinary care through the experiment. Approximately 30 days after calving, the reproductive tract of all cows were examined, and cows were treated for any health or reproductive disorders. The management of reproduction was based on a scheme of estrus synchronization.

Animals nutrition

Cows were kept in open shed during the dry period, fed hay and silage to cover the maintenance and pregnancy requirements. During the last 2 weeks of dry period, cows were also fed approximately 3 kg of dry matter of the ration that was fed to lactating cow. After calving, cows were fed *ad libitum* a total mixed diet containing 70% concentrates and 30% hay and silage. Vitamins and minerals were added to the mixed diets in quantities recommended by the US NRC (**NRC, 1978**). The only modification was that 150.000 to 200.000 IU of vitamin A were fed per cow per day.

Blood sampling

Blood samples were taken from each animal in both groups – before pregnancy (one month at 3 days intervals), during pregnancy (once a month for 9 months), and after parturition (one month at 3 days intervals) – via Jugular vein-puncture using 18 g needle and 20 cc syringes then deposited into heparinized vacutainer tubes. The vacutainer tubes were immediately placed in an ice water bath and centrifuged at 2000 rpm for at least 10 minutes at 4°c (**Wiseman *et al* 1983**). Plasma was collected and stored in 1.5 ml vials at -18°c until hormonal assay.

Progesterone assay

Determination of progesterone concentration in plasma was carried out by radioimmunoassay (RIA), according to **Rosenberg and Folman, (1977)**.

Statistical analysis

Estrus synchronization and pregnancy data were analyzed by ANOVA (analysis of variance) using General linear Models Procedure of **SAS. (1985)**.

RESULTS AND DISCUSSION

Estrous response

The present study indicated that cows given prostaglandins treatment appeared in estrus from starting program earlier than that of control cows (15 vs. 18 days), respectively **(Table 1)**.

The effect of the different synchronization treatments on the time interval from the last PGF2α injection to the onset of estrus was reported by many investigators. **Rosenberg *et al* (1990)**, showed that, 75٪ of the cows given two PG injections 11 days apart, and 79٪ of cows given two PG injections 14 days apart were detected in estrus within 7 days following the second PG injection. In another experiment, the same investigators reported that, 69٪ of the cows given the Prostaglandin (PG) – Progesterone releasing intravaginal device (PRID) – PG treatment, and 58٪ of the cows given a single PG injection were detected in estrus within 7 days following the PG injection.

The present study indicated that only the percentage of cows manifesting estrus were reduced in that of low plasma progesterone concentration. These results indicate that the conception rate of control cows was less than that of cows treated with PG **(Table 1)**.

Probably due to higher progesterone concentration preconception in the control group **(Table 2)**.

The number of animals displaying estrus in the treated and control groups are (15/20 = 75٪ vs 13/20= 65٪) respectively. Conception rates are (14/15=93.3٪) VS (11/13=84.6٪) respectively. Calving rates are (13/15 = 92.9) 86.66% vs (9/13 = 69.23) respectively. Days from calving to conception (97 vs 104) in the treated and control groups respectively **(Table 1)**.

Using prostaglandin F2α based estrus synchronization system increased animals becoming pregnant early in the breeding season. In the present study, 86.66% of cows become pregnant in the 1st month of the breeding season and calved. This increased pregnancy rate is probably due to higher progesterone concentration during pregnancy in the treated group compared to the control group **(Table 3)**, which may result in a decrease in the early embryonic mortality.

Plasma progesterone concentration

Before pregnancy

Animals in the treated group which were subjected to treatment system using prostaglandin F2α had average plasma progesterone of 2.62 ± 0.12, 2.55 ± 0.09, 2.39 ± 0.12, 2.34 ± 0.13, 2.4 ± 0.24, 3.35 ± 0.36, 1.35 ± 0.11, 4.14 ± 0.33, 2.52 ± 0.15 and 1.2 ± 0.07 ng/ml in the 30, 27, 24, 21, 18, 15, 12, 9, 6 and 3 days before pregnancy, respectively **(Table 2 and Figure 1)**.

The corresponding values in the control group were 3.34 ± 0.14, 3.08 ± 0.15, 2.7 ± 0.16, 2.64 ± 0.12, 2.39 ± 0.13, 3.22 ± 0.27, 3.32 ± 0.24, 3.38 ± 0.25, 2.51 ± 0.14 and 2.65 ± 0.23 ng/ml, respectively **(Table 1)**. The differences between the two experimental groups were statistically not significant. The coefficient of variability (CV ٪) was 19.66, 20.71, 26.62 24.08, 30.41, 44.04, 36.17, 35.13, 26.16 and 40.9 respectively, for the above-mentioned progression values.

Gestation period

Animals in the treated group which was subjected to treatment system. The first injection will interrupt the cycles of those cows with mature (more than 5 days old) CL's. Any normally cycling cow that did not have a mature CL at the time of the first injection should have one by the time of the second injection (11 days later), this group had average plasma progesterone of 26.16 ± 0.72, 32.89 ± 1.01, 37.12 ± 0.79, 38.84 ± 0.84, 40.75 ± 0.67, 49.55 ± 1.04, 48.9 ± 0.75, 50.17 ± 0.7 and 47.85 ± 0.62 ng/ml in the (1st, 2nd, 3rd , 4th , 5th, 6th , 7th , 8th and 9th month) of pregnancy, respectively **(Table 3)**.

While control group of jersey cows had average plasma progesterone concentration of 20.18 ± 0.83, 22.36 ± 0.73, 24.29 ± 0.60, 30.20 ± 0.59, 33.65±0.69, 37.52±0.91, 36.5 ± 0.73, 40.66 ± 1.09 and 39.71 ± 0.85 ng/ml, in the same period

Table 1. Reproductive parameters of Jersy cows in the synchronized and unsynchronized groups

Parameter	Treated group	Control group
Animal No.	20	20
Days to 1st estrus from starting program	15	18
No. and percent of animals showed estrus	(15/20) 75%	(13/20) 65%
Conception rate	(14/15) 93.3%	(11/13) 84.6%
Calving rate	(13/15) 86.66%	(9/13) 69.23%
Days from calving to conception (days open)	97	104

Table 2. Average plasma progesterone concentration (ng/ml) of Jersy cows one month before pregnancy in control and treated groups

Trial \ Time before Pregnancy (day)	-30	-27	-24	-21	-18	-15	-12	-9	-6	-3
Control Group (20)	3.43 ±0.14	3.08 ±0.15	2.7 ±0.17	2.34 ±0.13	2.39 ±0.13	3.22 ±0.27	3.33 ±0.24	3.38 ±0.25	2.51 ±0.14	2.65 ±0.24
Treated Group (20)	2.62 ±0.12	2.26 ±0.09	2.45 ±0.13	2.64 ±0.14	3.40 ±0.24	3.35 ±0.36	1.35 ±0.25	4.15 ±0.24	5.52 ±0.15	1.21 ±0.23
General Mean (40)	3.02	2.81	2.57	2.49	2.89	3.28	2.34	3.76	2.54	1.93

Table 3. Average plasma progesterone concentration (ng/ml) of Jersy cows during gestation in control and treated groups

Trial \ Months of pregnancy	1st month	2nd month	3rd month	4th month	5th month	6th month	7th month	8th month	9th month
Control Group (20)	20.21 ±1.58	22.44 ±2.06	24.29 ±1.34	30.2 ±1.51	33.6 ±1.39	37.5 ±1.07	36.13 ±1.23	40.75 ±1.95	39.12 ±1.03
Treated Group (20)	26.14 ±3.85	32.93 ±5.04	37.14 ±6.23	38.82 ±3.42	40.78 ±2.62	49.61 ±2.06	48.9 ±1.87	50.21 ±1.3	47.91 ±1.02
General Mean (40)	23.18	27.7	30.72	34.51	37.19	43.55	42.52	45.5	43.5

Table 4. Average plasma progesterone concentration (ng/ml) of Jersy cows during post partum period in control and treated groups

Days Post Partum / Experimental groups	3 days	6 days	9 days	12 days	15 days	18 days	21 days	24 days	27 days	30 days
Control Group (20)	8.5 ±0.59	7.6 ±0.56	6.2 ±0.76	2.34 ±0.13	2.39 ±0.13	3.22 ±0.27	3.33 ±0.24	2.9 ±0.60	2.2 ±0.46	3.8 ±0.77
Treated Group (20)	6.7 ±0.58	6.0 ±0.57	5.5 ±0.77	4.9 ±0.59	4.3 ±0.75	3.8 ±0.76	3.28 ±0.59	4.15 ±0.55	2.4 ±0.57	4.9 ±0.59
General Mean (40)	7.6	6.8	5.85	5.2	4.6	3.9	3.29	2.8	2.3	4.35

of time recorded previously **(Table 3)**. The differences between the two experimental groups from plasma progesterone concentration were statistically significant (P≤0.01). The coefficient of variability (CV%) was 15.53, 14.33, 10.34, 9.51, 8.2, 10.08, 7.79, 9.03 and 7.63, respectively during the same period of time recorded previously.

Clearly data in **Table (3)** and **Figure (2)** indicates that, plasma progesterone concentrations in the treated group were higher (P≤0.01) than those of control group. This fact was in agreement with previous studies carried out with untreated animals where progesterone was measured in plasma (**Rosenberg and Folman, 1977, Carstairs *et al* 1980, Holness *et al* 1981, Fonseca *et al* 1983 and Rosenberg *et al* 1990**).

The significantly increase in plasma progesterone of treated cows in comparison with control cows during the months of gestation suggests that, in control animals, the corpus luteum may secrete less progesterone than that in treated cows or as result of feedback mechanism, this conclusion was in agreement with previous studies carried out by **Hooley *et al* (1974), Goodman *et al* (1981) and Batra and Miller (1985)**.

It could be noticed also from **Fig. (2)** that progesterone concentration in both groups decreased sharply after the 9th month of gestation which would be one of the proper hormonal balance necessary for the expulsion of the fetus at the time of delivery which usually occurs in Jersey cows after a gestation length of (9) months.

Post Partum Period

Jersy cows in the treated group which was subjected to treatment system had average plasma progesterone of 6.7 ± 0.58, 6.0 ± 0.57, 5.5 ± 0.77, 4.9 ± 0.59, 4.3 ± 0.75, 3.8 ± 0.67, 3.28 ± 0.59, 2.7 ± 0.55, 2.4 ± 0.57 and 4.9 ± 0.59 ng/ml in the 3, 6, 9, 12, 15, 15, 21, 24, 27 and 30 days after parturition, respectively **(Table 4)**.

On the other hand, control jersey cow had average plasma progesterone concentration of 8.50 ± 0.59, 7.60 ± 0.56, 6.20 ± 0.76, 5.50 ± 0.74, 4.90 ± 0.72, 4.00 ± 0.53, 3.30 ± 0.52, 2.90 ± 0.60, 2.20 ± 0.46 and 3.80 ± 0.77 ng/ml in the corresponding period reported previously **(Table 4)**. The differences between the two experimental groups concerning plasma progesterone concentration were statistically not significant. The coefficient of variability (CV%) was 34.45, 34.84, 36.76, 31.33, 29.4, 28.94, 30.3, 33.46, 29.11 and 30.83 respectively during the same period of time recorded previously.

Data in **Table (4)** and **Figure (3)** indicated that, plasma progesterone concentration in the treated group were statistically not significantly different than that in control group, during post-partum period. Results shown in **Table (4)** and **Figure (3)** demonstrated that there were a sharp decrease in plasma progesterone concentration in both experimental groups after parturition, this conclusion was in agreement with those studies reported by (**Henricks and Johnston, 1972 and Smith *et al* 1973**).

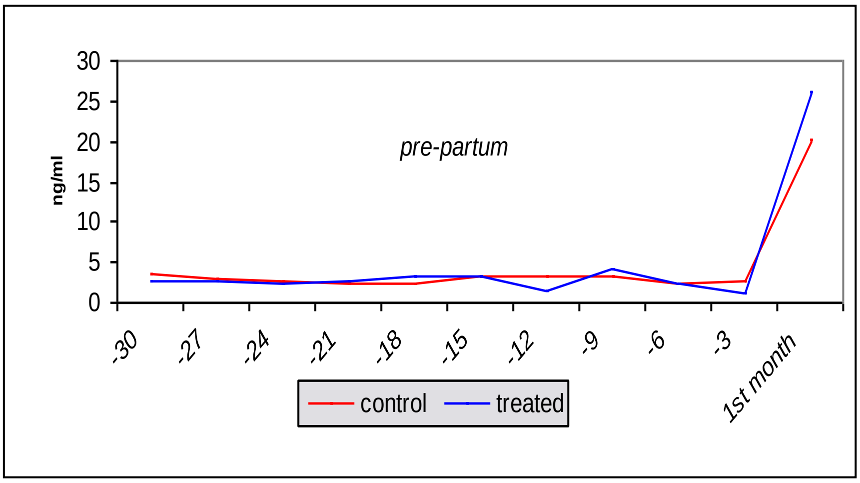

Fig. 1. Plasma progesterone concentrations before pregnancy

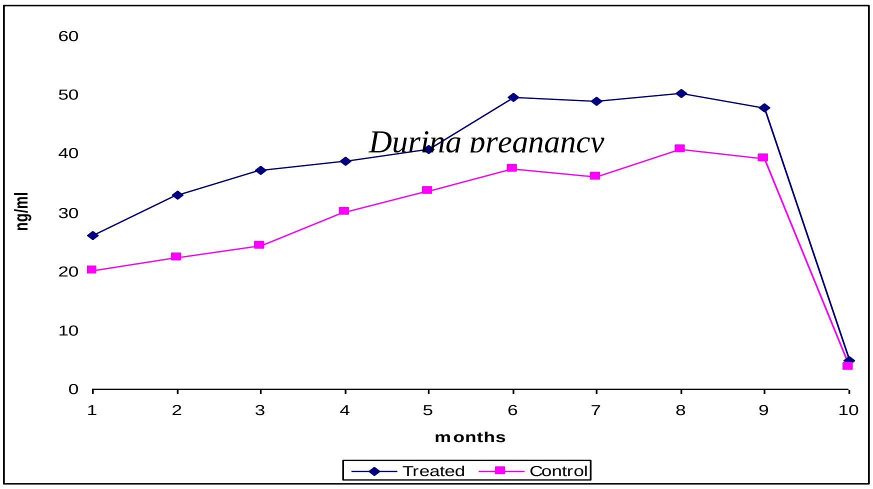

Fig. 2. Plasma progesterone concentrations during pregnancy

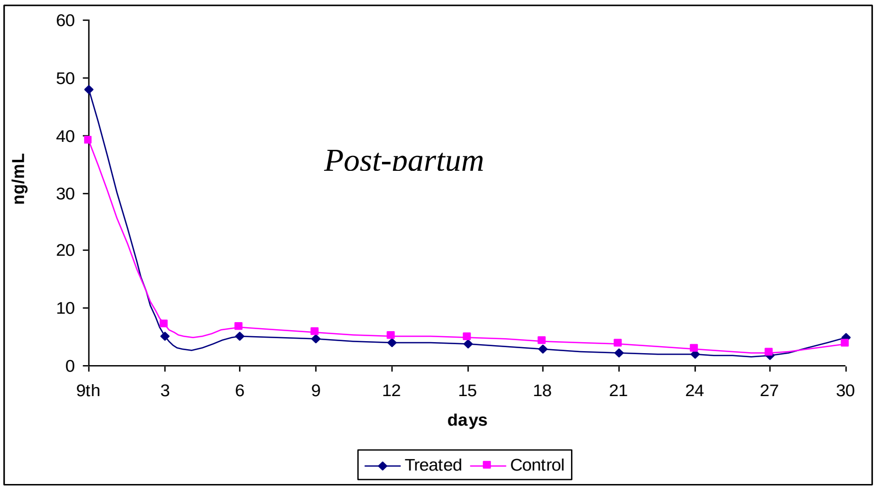

Fig. 3. Plasma progesterone concentrations after pregnancy

Plasma progesterone concentration before, during and after prgnancy

This decline in progesterone concentration in the postpartum period is required for the enhancement of the ovarian activity and recyclicity of the cows, since the inhibiting negative feedback effect of P_4 will be diminished, increasing GnRH, FSH, and LH.

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