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ROLE OF SINGLE INJECTION OF PROSTAGLANDIN F2 ALPHA ON BREEDING EFFICIENCY OF POSTPARTUM BUFFALOES

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ABSTRACT

In the present study, 20 Nili-Ravi buffaloes were divided into two equal groups. Group A buffaloes (treatment group) were administered with prostaglandin F2 alpha (Lutalyse, Upjohn), 2 hours after calving while the group B buffaloes served as untreated control. The reproductive organs of each experimental buffalo were rectally palpated on days 14 and 21 postpartum, followed by twice a week observation until the first postpartum oestrus. The results revealed that cervical and uterine involution was completed significantly ($P< 0.05$) earlier in buffaloes of group A as compared to group B (28.90 ± 1.79 vs. 35.40 ± 3.95 days). There was no difference in the diameter of cervices and gravid and non-gravid uterine horns at day 14 postpartum. A significant difference between the groups was recorded on days 21, 25, 28 and 32 postpartum in the diameter of cervices and gravid horns (on days 21, 25 and 28). The overall period required for complete regression of corpus luteum of pregnancy was 19.20 ± 4.87 days in treated group and 18.40 ± 6.07 days in control group, the difference was non-significant ($P>0.05$). Follicular activity resumed independently of uterine involution. It was however, delayed slightly by the retained corpus luteum of pregnancy. The mean postpartum interval of initial follicular development was 21.20 ± 5.71 days in treated and 28.20 ± 8.75 days in control groups; the difference was statistically significant ($P< 0.05$). Postpartum oestrus interval was shortened ($P<0.05$) in treated group (79.50 ± 19.83 days) as compared to control group (103.0 ± 17.45 days). So, it seems beneficial to administer prostaglandin F2 alpha in postpartum buffaloes to reduce the period for uterine involution and enhance the subsequent reproductive performance.

Key Words: Prostaglandin F2 alpha, breeding efficiency, buffaloes, postpartum.

INTRODUCTION

Pakistan is inhabitant of two genetically superior buffalo breeds i.e., Nili-Ravi and Kundi. In Pakistan, buffalo contributes about 75% of total milk production (Naqvi and Baig, 1994) and occupies a key position in the economy of the small and landless farmers. In spite of large population of buffaloes, the increasing demand of milk is not being met fully, particularly in the summer season when the requirement is even greater compared to the winter season. Low milk production during summer has been attributed to the seasonal calving trend in animals of this species. The lower reproductive efficiency of buffaloes is widely accepted as a constraint to milk production.

Some of the factors affecting reproductive efficiency of the buffalo are late maturity, delayed resumption of postpartum oestrus, silent heat, anoestrus, repeat breeding and seasonal influence on reproduction. Delay in the completion of uterine involution and resumption of postpartum ovarian activity decrease the reproductive efficiency by prolonging the subsequent calving interval. Delay in involution of uterus and postpartum ovarian activity has been reported due to short periods of high prostaglandin F2 alpha metabolite release in cows while, long duration of prostaglandin F2 alpha release resulted in short period for completion of uterine involution (Lindell *et al.*, 1980). Prostaglandin F2 alpha has a positive effect on uterine tone (Lindell and Kindahl, 1983) and it may be implicated in the resumption of ovarian activity (Guilbault *et al.*, 1984). Previous studies also provide evidence that the exogenous administration of prostaglandin F2 alpha may shorten the interval from parturition to complete involution of uterus in dairy cattle (Steffen *et al.*, 1984).

Despite extensive studies on the influence of exogenous prostaglandin on the time needed for restoration of utero-ovarian cyclicity after birth in dairy cows, little work has been done in the buffalo. Since early oestrus after calving reduces the open days of farm animals, prostaglandin F2 alpha has been used for reproductive management of herds in developed countries. The present project was aimed to study the effect of single injection of prostaglandin F2 alpha immediately after calving on involution of uterus, ovarian activity and postpartum oestrus interval in Nili-Ravi buffaloes.

MATERIALS AND METHODS

This study was carried out at the Livestock Production Research Institute, Bahadar Nagar, Okara. Twenty pregnant Nili-Ravi buffaloes with no history of reproductive disorders during, and after, the previous calving were selected. The parity of the experimental buffaloes ranged from 1 to 7. The buffaloes were randomly divided into two groups viz., A and B, with 10 animals in each group. Group A was distinguished as treated and group B as untreated control group.

During the study period, the experimental buffaloes were maintained in an open barn with semi-covered sheds under normal managerial conditions. The newborn calves were separated from the dams after 3-5 days of calving. The buffaloes were hand milked twice daily i.e., in the morning and evening.

Each buffalo in group A received a single injection of 5 ml Lutalyse (Upjohn) containing 25 mg Dinoprost Tromethamine, a natural PGF2 alpha, intramuscularly 2 hours after calving. The buffaloes in group B were not given any treatment and served as control. All the experimental animals were observed from the day of calving to the first recorded postpartum oestrus. The reproductive organs of each experimental buffalo were rectally palpated on days 14 and 21 postpartum, followed by twice a week rectal palpation until the first postpartum oestrus. Diameter and length of cervix, diameter of each horn of the uterus and location of the uterus were recorded. For this purpose, three numerical codes were fixed for different positions of the uterus during different stages of involution period, as pelvic position (1.0), half pelvic (0.5) and abdominal (0.0). Four numerical codes were fixed for different types of tonicities of the uterus at different stages of involution as, erect, turgid and oestrus like (1), good tone, less turgid than at oestrus (2), fair tone and flaccid horns (3) and no resistance to touch (4). Ovaries were also palpated to record the volume, development of follicles and regression of corpus luteum. Uterine involution was considered complete with the return of uterus into pelvic area or non-pregnant position, return of uterine horns to non-pregnant size and return of uterus to attain non-pregnant tone. The oestrus observation was started on day 45 postpartum. Buffaloes detected in oestrus were inseminated twelve hours after the onset of oestrus. Data regarding involution of uterus, ovarian volume and postpartum oestrus interval were subjected to " t " test for statistical analysis to find out difference between treated and control groups (Steel and Torrie, 1982).

RESULTS AND DISCUSSION

Diameter of cervix

The cervices of group A buffaloes reattained non-pregnant diameter significantly earlier ($P<0.05$) than those of group B buffaloes. On day 14 postpartum, there was no significant difference in the diameter of cervices between the animals of groups A and B. The significant ($P<0.05$) difference was observed on days 21, 25, 28 and 32 postpartum, while it was non-significant ($P>0.05$) on day 36 postpartum (Table 1).

Diameter of non-gravid horns

The data in Table 1 show no statistical difference in the diameter of non-gravid uterine horns between groups A and B at any of the day of palpation postpartum.

Table 1: Mean ± SD diameter (mm) of cervix, gravid and non-gravid horns at different stages of involution in buffaloes of two groups (n=10)

Days post partum	Cervix		Gravid horn		Non-gravid horn	
	Group A	Group B	Group A	Group B	Group A	Group B
14	98.00 ± 14.76	103.00 ± 14.18	77.50 ± 16.71	86.50 ± 12.26	35.50 ± 3.68	39.00 ± 3.94
21	58.00 ± 9.77	73.00 ± 12.74*	50.50 ± 11.65	62.50 ± 10.61*	30.80 ± 2.30	32.00 ± 3.49
25	42.00 ± 6.74	56.00 ± 10.55*	34.60 ± 7.12	46.30 ± 8.62*	29.60 ± 0.84	29.60 ± 0.84
28	33.50 ± 3.37	42.50 ± 7.16*	29.50 ± 2.17	35.60 ± 6.18*	29.00 ± 1.05	28.80 ± 1.03
32	32.00 ± 2.58	38.50 ± 6.25*	29.00 ± 1.05	31.40 ± 4.57	28.70 ± 1.03	28.70 ± 1.40
36	32.00 ± 2.58	34.50 ± 3.68	29.00 ± 1.05	29.40 ± 2.45	28.70 ± 1.05	28.60 ± 1.84

* = Significantly different from control group at $P<0.05$

Diameter of gravid horns

Table 1 indicates a non-significant (P>0.05) difference in the diameter of gravid horns on day 14 postpartum between the two groups (77.50 ± 16.71 mm in group A and 86.50 ± 12.26 mm in group B). On day 21 postpartum, the diameter of the gravid horn was 50.50 ± 11.65 mm in group A and 62.50 ± 10.61 mm in group B and the difference was statistically significant (P<0.05). The diameter of the gravid horn was significantly (P<0.05) shorter in group A than that of group B on days 21, 25 and 28. However, no statistical difference in diameter of gravid horns was observed on days 32 and 36 between the two experimental groups.

Chauhan *et al.* (1977) reported average diameter of gravid and non-gravid uterine horns and cervix as 2.3, 2.3 and 2.2 cm on complete involution, respectively. These values are relatively lower than the values of this study. Our findings are in agreement with the observations of Ahmed *et al.* (1978), who observed that rate of involution of the various components of the uterus was almost similar from day 7 to 14 and from day 14 to 21 postpartum. Chaudhry *et al.* (1987) also recorded mean diameter of cervix, gravid and non-gravid horns as 73.00 ± 15.9, 60.0 ± 13.6 and 32.8 ± 5.3 mm, respectively on day 14 postpartum in Nili-Ravi buffaloes. On complete involution of uterus, the respective diameters were 37.8 ± 9.4, 29.6 ± 4.7 and 29.3 ± 4.1 mm. The rate of involution of gravid horn (1.1 mm/day) was significantly faster than the non-gravid horn (0.1 mm/day). Similarly, Usmani and Lewis (1984) reported that all the three components of the uterus (cervix, gravid and non-gravid horns) involuted simultaneously. On day 14 postpartum, the mean diameter of the cervix, gravid and non-gravid horns was 106.2 ± 3.7, 60.40 ± 2.20 and 47 ± 1.4 mm, respectively. The corresponding diameter at the completion of involution was 51.5 ± 2.2, 33.3 ± 1.1 and 30.0 ± 1.0 mm, respectively. The rate of decrease in the diameter of gravid horn was significantly higher (1.0 mm/day) than that of non-gravid horn (0.7 mm/day). However, these values were much higher than our findings. Devanathan *et al.* (1987) reported that gravid horn involuted more rapidly than non-gravid horn and complete involution occurred between 29th and 36th day postpartum. However, the involution of cervix was gradual and uniform from 5th to 36th day postpartum. Farrukh (1993) also reported that there was significant difference in the diameter of cervix, gravid and non-gravid uterine horns after parturition up to complete uterine involution in prostaglandin treated and control groups.

Postpartum uterine location

On day 28 postpartum, 9 out of 10 buffaloes had pelvic uterus in group A and one buffalo had half pelvic uterus, compared to five out of 10 in group B (Table 2). Abdominal location of the uterus was noted in 3 buffaloes only up to day 14 postpartum in group A, whereas in group B 3 buffaloes had abdominal uterus on day 21 postpartum. In group A uterus attained pelvic location 4 days earlier than that of group B (32 vs. 36 days). Ali *et al.* (1980) reported that the uterus returned to normal size, tone and location at 41.64 ± 3.30 days postpartum in buffalo heifers. The gravid horns were located on the brim of pelvic cavity by day 14 postpartum in 70% buffaloes (half pelvic) whereas, 30% buffaloes had abdominal uterus.

Postpartum uterine tone

On day 14 postpartum, 6 and 4 animals had fair tone and flaccid horns in groups A and B, respectively (Table 3). Oestrus like tone was noted 3 days earlier in group A than that of group B. On day 28 postpartum, 5 and 2 buffaloes had good tone in group A and group B, respectively. From day 32 and 36 postpartum, uterus was flaccid in 6 animals of group B and 4 animals of group A. It is generally believed that the uterine horns exhibit tonicity for a few days following parturition under influence of rising levels of estrogen. Again when the process of involution is completed and ovarian activity starts, the uterine horns start exhibiting tonicity in accordance with the waves of follicular development.

Uterine involution

The period for uterine involution was significantly (P<0.05) shorter in group A as compared to group B (28.90 ± 1.792 vs. 35.40 ± 3.95 days). This indicates that prostaglandin F2 alpha has a significant effect on uterine involution. The rate of decrease in the size of genitalia was faster in treated group than the control group. These results are in agreement with the earlier findings of Lindell *et al.* (1980) and Okuda *et al.* (1988), who reported early uterine involution in prostaglandin F2 alpha treated cows than control group. Similarly, Farrukh (1993) reported significant effect of prostaglandin F2 alpha on the uterine involution in Nili-Ravi buffaloes. However, the period observed for complete uterine involution was less both in treated and control groups (24.88 ± 0.97 and 29.75 ± 0.75 days, respectively) as compared to our findings. As far as uterine involution in the untreated control group is concerned, our results are compatible with the earlier observations of Bhalla *et al.* (1966), who reported a period of 29.8 ± 0.73 days for uterine involution in Indian buffaloes. However, Chauhan *et al.* (1977) and

Table 2: Location of uterus after different postpartum days (n=10)

Location	Groups	Days postpartum/Number of animals					
		14	21	25	28	32	36
Pelvic (code 1.0)	A	0	0	6	9	10	10
	B	0	0	3	5	7	10
Half pelvic (code 0.5)	A	7	10	4	1	0	0
	B	7	7	7	5	3	0
Abdominal (code 0.0)	A	3	0	0	0	0	0
	B	3	3	0	0	0	0

Table 3: Uterine tone after different postpartum days (n=10)

Days post partum	Groups	Uterine tone erect and turgid (oestrus like)	Good tone, less turgid than at oestrus	Fair tone, flaccid horns	No resistance to touch
14	A	0	0	6	4
	B	0	0	4	6
21	A	0	0	10	0
	B	0	0	8	2
25	A	1	2	7	0
	B	0	1	8	1
28	A	1	5	4	0
	B	1	2	7	0
32	A	1	5	4	0
	B	2	2	6	0
36	A	2	4	4	0
	B	2	2	6	0

Ali *et al.* (1980) reported longer uterine involution intervals of 38.8 and 41. 64 days, respectively whereas, Usmani *et al.* (1985) and Chaudhry *et al.* (1987) observed relatively shorter intervals for uterine involution i.e., 26 and 27.5 days, respectively. The difference in these observations might be due to different breeds, management, and nutritional status of the animals, experimental protocol and season of study.

Postpartum oestrus interval

The mean postpartum period from calving to first observable oestrus was 79.50 ± 19.83 days in group A (range 42-104 days) and 103.0 ± 17.45 days in group B (range 89-134 days), the difference was statistically significant ($P<0.05$). Thus, the postpartum oestrus interval was significantly affected by prostaglandin therapy. These findings are supported by the observations of Singh *et al.* (1979) and Farrukh (1993), who reported significant effect of prostaglandin treatment on postpartum oestrus interval in Nili-Ravi buffaloes. It seems that prostaglandin F2 alpha injection caused the drop in blood progesterone concentration in the treated group. Consequently, there was an increase in secretion of FSH and LH, and thus follicles started growing. Measurement of progesterone profile during postpartum period after prostaglandin treatment could be an interesting observation in explaining the functional regression of CL in future studies.

Postpartum ovarian activity

The difference in the overall period from parturition to complete regression of corpus luteum (CL) was statistically non significant ($P>0.05$) between the groups A and B (19.20 ± 4.87 vs. 18.40 ± 6.07 days). The method of rectal palpation for CL detection is not very accurate because it only indicates structural presence of CL and not the functional status and the ability to palpate CL also varies among different workers. Moreover, it is difficult to differentiate between early CL and small follicles (>10 mm in diameter) raised above the ovarian surface. However, our findings are in close conformity with the observations of Singh *et al.* (1979), Usmani (1983) and Devanathan *et al.* (1987). Jainudeen *et al.* (1983) reported 10 days period for CL regression in Swamp buffaloes. In our study, functional regression of CL was not measured which always occur earlier than structural regression.

Postpartum follicular activity started by day 21.20 ± 5.71 in group A and by day 28.20 ± 8.53 postpartum in group B, the difference was significant ($P<0.05$). Similar observations were made by Singh *et al.* (1979) in Murrah buffaloes and Usmani (1983) in Nili-Ravi buffaloes. Follicular activity resumed independently of uterine involution. Most of these follicles did not result in ovulation but became atretic within a week and then new follicles followed their regression.

The ovarian volume was calculated by multiplying the length, width and thickness of the ovaries. There was no significant difference in the volume of ovaries ipsilateral to gravid horns in prostaglandin treated and control groups (9.94 ± 2.45 vs. 10.97 ± 5.10 cm) whereas, a significant difference was observed in volume of the ovaries ipsilateral to non-gravid horns in corresponding groups (8.58 ± 5.22 vs. 6.33 ± 2.87 cm). Farrukh (1993) reported that ovarian volume ipsilateral to gravid uterine horn differed significantly in treated and control groups (6.66 ± 0.97 vs. 11.30 ± 1.91 cm). In contrast, there was no significant difference in the ovarian volume ipsilateral to non-gravid horns in both the groups (7.86 ± 1.02 vs. 8.26 ± 0.96 cm).

On the basis of the results of the present study, it can be concluded that prostaglandin F2 alpha administration immediately following parturition is beneficial to reduce the uterine involution period and postpartum oestrus interval. This will result in shortening of the calving interval and enhancement of the reproductive efficiency in Nili-Ravi buffaloes.

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