Research Article

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EFFECT OF PROSTAGLANDIN $F_{2\alpha}$ ADMINISTRATION AT THE TIME OF INSEMINATION ON CONCEPTION RATE IN MURRAH BUFFALO

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ABSTRACT

Breeding management programs optimize the productivity, reproductive efficiency and profit potential of animals. Lutalyse (dinoprost tromethamine) is the naturally occurring prostaglandin $F_{2\alpha}$ ($PGF_{2\alpha}$) that help in controlling breeding programs. In this study, about 595 Murrah buffaloes and heifers of University Buffalo Farm were selected and randomly divided into two groups. Group I animals were administered 10mg prostaglandin $F_{2\alpha}$ intramuscularly at the time of artificial insemination (AI) and group II was kept as control i.e. AI with saline injection. The treated and untreated buffaloes were monitored for fertility and production parameters. Pregnancy diagnosis was performed by rectal examination after 60-90 days of insemination. It was observed that the conception rate in group I Murrah buffaloes was higher (48.26%) than group II animals (42.45%). However, other reproduction and production parameters *viz*., service period, calving to service interval, lactation length, total milk yield per lactation and peak milk yield showed non significant variations between two groups. Thus, it can be concluded that low dose prostaglandin supplemented at the time of insemination improves the conception rate without causing any ill-effect on health, production and reproduction in buffaloes.

Key words: Artificial insemination, Conception rate, Murrah buffalo, Prostaglandin $F_{2\alpha}$, Reproduction

Buffaloes are well known for providing good quality milk, meat and draught power and thus have a significant role in agrarian economy of developing countries. Although buffaloes can utilize poor quality roughages, adapt to harsh environment and are more resistant to several bovine tropical diseases but have relatively poor reproductive efficiency throughout the world. Reproductive efficiency is the primary factor affecting productivity and is hampered in female buffalo, due to late attainment of puberty, seasonality of calving, long postpartum anoestrus and subsequent increased calving interval. Moreover, buffaloes show weak oestrus symptoms and have variable oestrus length making oestrus detection very difficult. This leads to lowered conception rates in buffalo with artificial insemination (Gordon, 1996).

The opportunities for increasing conception rates are limited in well-managed dairy herds. Several studies have been carried out to understand the reproductive physiology of buffalo so as to improve reproductive efficiency, predominantly when using controlled breeding techniques. Higher fertility in buffalo could be achieved through better feeding and management (Perera *et al*., 1987; Usmani *et al*., 1990; Qureshi *et al*., 2007). The conception rate can be augmented by administering either GnRH (Lopez-Gatius *et al*., 2006) or $PGF_{2\alpha}$ (Ambrose *et al*., 2015) at the time of artificial insemination (AI). Although an injection of a luteolytic dose of $PGF_{2\alpha}$ analogue to the cow at the time of the estrous cycle increases the intraluteal production of vasoactive substances such as endothelin-1 (Ohtani *et al*., 1998) and angiotensin II (Hayashi *et al*., 2001), both of which play important roles in luteolytic cascade. However, a $PGF_{2\alpha}$ analogue injection before corpus luteum (CL) formation, causes an increase of plasma progesterone (P4) concentration and an increased volume of the CL between day 4 and 6 of estrous cycle in cattle (Acosta *et al*., 2002).

Administration of prostaglandin $F_{2\alpha}$ at the time of insemination has been reported to improve the conception rate (Lopez-Gatius *et al*., 2004; Weems *et al*., 2006; Ambrose *et al*., 2015), but there is also evidence to the contrary (Kauffold *et al*., 2009). Prostaglandin $F_{2\alpha}$ is supposed to exert effect on spermatozoa motility or uterine contractility, thus the present study deals with the query whether it is possible to improve the conception rate in buffaloes by intramuscular administration of prostaglandin $F_{2\alpha}$ at the time of AI. Since even a small increase in conception rate could contribute to overall improvement in reproductive efficiency, studies on the efficacy of giving $PGF_{2\alpha}$ concurrent with AI to increase conception rate are defendable. Thus, the hypothesis of the study was that low intramuscular doses of $PGF_{2\alpha}$ at the time of AI would improve conception rates in Murrah buffaloes.

MATERIALS AND METHODS

Location and climate

The experimental trial was conducted in 19 months duration at the Buffalo Farm, Department of Livestock Production and Management, Lala Lajpat Rai University of Veterinary and Animal Sciences, Hisar (Haryana), which is situated in Trans-Gangetic plain region of India at longitude 75° 43' 02.84" E and the latitude of 29° 09' 14.28" N and at altitude of 234 m above mean sea level. The average annual maximum and minimum ambient temperature ranges between 6 and 46°C. The mean annual relative humidity ranges between 20 and 85 %. The annual rainfall in this area ranges between 350 to 455 mm with an intermittent distribution throughout the year.

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Experimental animals

Murrah buffaloes in the shed were provided with *ad libitum* feed and water of good quality. Optimum body condition score (BCS) between 3-3.5 and managemental care was confirmed in each animal as per the BCS score card (Balakrishnan *et al*. 1997).

Adult Murrah buffaloes between first to fourth parity and heifers were included in the present study. Only first insemination was taken into consideration. Animals were inseminated 8-12 hours after estrus was first detected. Prior to insemination each animal was inspected for clinical and gynaecological soundness by rectal palplation. A total of 595 animals were inseminated with frozen thawed semen (20 X 10^6 live spermatozoa prior to freezing/ dose) of proven sires during this period. Animals were randomly divided into two groups. Group I included buffaloes that were administered low dose (10mg) prostaglandin $F_{2\alpha}$ (2ml Dinoprost tromethamine) intramuscularly within 1 min after insemination. Group II (Control) included buffaloes which received an infusion of same volume (2 ml) of sterile physiological saline at the time of insemination. Pregnancy was diagnosed by rectal palpation 60 to 90 days after insemination.

Parameters studied

The parameters recorded were conception rate, service interval (days-to-first service), service period (days open), lactation length, total milk yield per lactation, peak milk yield per lactation and number of abortions. Conception rate is the percentage of number of females that conceived divided by the number of females undergone AI. Days-to-first service is the time from when a buffalo calved until the first time inseminated. Days open is the time interval between calving to conception. Lactation period is the period after parturition till animal becomes dry again. Total milk yield per lactation is determined by the amount of milk produced (in litres) by a buffalo after parturition during the lactation cycle. Peak milk yield is the point where animal reaches the highest milk production level during the entire lactation. The data obtained was analyzed statistically with analysis of variance (Snedecor and Cochran 1994).

RESULTS AND DISCUSSION

From total number of 595 buffaloes inseminated in entire course of trial, 259 animals were administered prostaglandin injection (group I) at the time of insemination and group II included 336 animals (Table 1). These animals were further categorized into primiparous and multiparous animals. Group I included 85 pluriparous and 174 multiparous animals, while group II contained 102 primiparous and 234 pluriparous animals. The overall conception rate was higher in group I animals (48.26%) as compared to group II (42.42%; Table 2). The primiparous animals of group I showed significantly greater conception rate (55.29%) than those of group II animals (45.01%). The conception rate in multiparous animals was comparable in group I (44.82%) and group II (41.45%). These observations are in agreement with the findings of Ambrose *et al*. (2015) who reported that treatment with 5mg of $PGF_{2\alpha}$ given IM concurrent with timed AI failed to enhance conception rate in lactating dairy cows, whereas 10 mg of $PGF_{2\alpha}$ significantly increased conception rate in dairy cattle. However another group of workers reported that IM treatment of lactating dairy cows with 10 mg of $PGF_{2\alpha}$ concurrent with timed AI did not improve conception rate or embryo survival, but increased twinning in one herd (Sauls *et al*., 2018).

Table 1:
Month - wise conception rate in treated and control animals

S. No.	Month	Group I (AI + $PGF_{2\alpha}$)			Group II (AI + saline)		
		Insem-inated	Conc-eived	% Conceived	Insem-inated	Conc-eived	% Conceived
1	August	3	3	100.00	19	6	31.57
2	September	21	6	28.57	21	3	14 .28
3	October	22	9	40.91	18	9	50.00
4	November	20	14	70.00	19	10	52.63
5	December	15	9	60.00	25	8	32.00
6	January	18	11	61.11	27	17	62.96
7	February	9	5	55.56	15	7	46.67
8	March	8	3	37.50	19	8	42.10
9	April	11	6	54.54	2	0	0.00
10	May	10	5	50.00	3	1	33.33
11	June	9	0	0.00	4	1	25.00
12	July	15	7	46.67	6	4	66.67
13	August	9	7	77.78	10	4	40.00
14	September	19	4	21.05	9	3	33.33
15	October	10	6	60.00	18	7	38.89
16	November	17	9	52.94	21	10	47.62
17	December	8	5	62.50	22	11	50.00
18	January	2	0	0.0	22	14	63.63
19	February	4	3	75.00	7	5	71.42

Other parameters related to reproduction were also estimated, that included service interval, no. of days open, lactation length, total milk yield per lactation

Table 2:
Conception rate in animals

Parameters	Group I	Group II
No. of animals inseminated	259	336
No. of animals conceived	125	143
Overall conception rate (%)	48.26	42.45
No. of primiparous animals inseminated	85	102
No. of primiparous animals conceived	47	46
Conception rate in primiparous animals (%)	55.29 [a]	45.01 [b]
No. of multiparous animals inseminated	174	234
No. of multiparous animals conceived	78	97
Conception rate in multiparous animals (%)	44.82	41.45

Values bearing superscript differ significantly (P <0.05)

Table 3:
Parameters related to reproductionand production in different groups

Parameters	Group I	Group II
Days-to-first service (days) [Service interval]	111.41±7.71	122.91±9.78
Days open (days) [Service period]	147.7±10.93	138.95±12.88
Lactation length (days)	317.94±8.33	321.60±10.56
MY/Lactation (liters)	2899.21±90.61	2973.84±120.16
Peak Milk yield (liters)	14.58±0.39	14.06±0.42

and peak milk yield per lactation (Table 3). The number of abortions was less than 1% in both the groups. There was non significant variation in the levels of other reproductive and lactation parameters for the group I and II indicating no side effect of $PGF_{2\alpha}$ on the reproductive and lactation parameters of the animals.

Administration of $PGF_{2\alpha}$ synchronized with artificial insemination results in increased uterine contractility (Stolla and Schmidt, 1990), thereby enhancing sperm transport (Hawk, 1983) in the female reproductive tract resulting in increased chances of conception. This may also hastens luteal regression that may otherwise have delayed or incomplete luteolysis at AI (Leonardi *et al*., 2012) or it might increase the ovulatory process via a luteolysis independent mechanism in buffalo. This creates a low progesterone environment that becomes conducive for optimal gamete transport leading to increase in conception rates and fertility enhancement. Moreover, a $PGF_{2\alpha}$ analogue injection before corpus luteum (CL) formation, causes an increase of plasma progesterone concentration and an increased volume of the CL between day 4 and 6 of the cycle in cattle (Acosta *et al*., 2002). Ohtani *et al*. (1998) and Hayashi *et al*. (2001) also reported that administration of luteolytic dose of PGF analogue to cow during middle stage of estrous cycle results in an increased intraluteal production of vasoactive substances such as endothelin-1 and angiotensin II which play important roles in the luteolysis process. Treatment with $PGF_{2\alpha}$ before day 5 of the estrous cycle may lead to specific changes in genes expression, which prevents the intraluteal production of these molecules (Tsai and Wiltbank, 1998). Furthermore, high concentrations of endothelin-1 inhibit progesterone production from luteal cells (Rizzo *et al*., 2003). These effects of endothelin-1 may be abolished by specific endothelin-1 receptors antagonists such as prostaglandins, which are able to prolong CL life span (Girsh *et al*., 1996). Low dose of prostaglandin given concurrent with AI in the present study improved conception rate through any of or all the aforementioned mechanisms.

Thus it was concluded that administration of low dose prostaglandin $F_{2\alpha}$ at the time of insemination to the buffaloes resulted in increased overall conception rate, significantly increased conception in primiparous animals and simultaneously there was no side effect on the health, production and reproduction status of animals.

REFERENCES

Acosta, T.J., Yoshizawa, N., Ohtani, M. and Miyamoto, A. (2002). Local Changes in Blood Flow within the Early and Midcycle Corpus Luteum after Prostaglandin F2α injection in the Cow. *Biol. Reprod.* **66**: 651–58.

Ambrose, D.J., Gobikrushanth, M., Zuidhof, S. and Kastelic J.P. (2015). Low-dose natural prostaglandin F2α (dinoprost) at timed insemination improves conception rate in dairy cattle. *Theriogenol.* **83**: 529–34

Balakrishnan, M., Ramesha, K.P. and Chinnaiya, G.P. (1997). Effect of post-partum body condition loss on performance in crossbred cows an assessment through body condition scoring. *Indian J. Dairy Sci.* **50**: 393-397

Girsh, E., Wang, W., Mamluk, R., Arditi, F., Friedman, A., Milvae, R.A. and Meidan, R. (1996). Regulation of endothelin-1 expression in the bovine corpus luteum: elevation by prostaglandin $F_{2\alpha}$. *Endocrinol*. **137**: 5191–96.

Gordon, I. (1996). Controlled reproduction in cattle and buffaloes. CABI, Wallingford, UK. vol. 1. pp. 452.

Hawk, H.W. (1983). Sperm survival and transport in the female reproductive tract. *J. Dairy Sci.* **66**: 2645–60.

Hayashi, K., Acosta, T.J., Berisha, B., Kobayashi, S., Ozawa, T., Fukuda, R., Kojima, A., Othani, M., Schams, D. and Miyamoto, A. (2001). Real-time changes in the local angiotensin system and prostaglandin production in the regressing corpus luteum in the cow. *Biol. Reprod.* **64**: 132-35.

Kauffold, J., Gommel, R., Richter, A., Beynon, N. and Wehrend, A. (2009). Post-insemination treatment of primiparous and multiparous cows with cloprostenol failed to affect ovulation and pregnancy rate in dairy. *Theriogenol.* **72**: 741–46.

Leonardi, C.E.P., Pfeifer, L.F.M., Rubina, M.I.B., Singh, J., Mapletoft, R.J. and Pessoa, G.A. (2012). Prostaglandin F promotes ovulation in prepubertal heifers. *Theriogenol.* **78**:1578–82.

Lopez-Gatius, F., Santolaria, P., Martino, A., Deletang, F. and De Rensis, F. (2006). The effects of GnRH treatment at the time of AI and 12 days later on reproductive performance of high producing dairy cows during the warm season in northeastern Spain. *Theriogenol.* **65**: 820–30.

Lopez-Gatius, F., Yániz, J.L., Santolaria, P., Murugavel, K., Guijarro, R., Calvo, E. and Lopez-Bejar, M. (2004). Reproductive performance of lactating dairy cows treated with cloprostenol at the time of insemination. *Theriogenol.* **62**: 677–89.

Ohtani, M., Kobayashi, S., Miyamoto, A., Hayashi, K. and Fukui, Y. (1998). Real-time relationships between intraluteal and plasma concentrations of endothelin, oxytocin and progesterone during prostaglandin $F_{2\alpha}$ -induced luteolysis in the cow. *Biol. Reprod.* **58**:103–108.

Perera, B.M.A.O. (1987). A review of experiences with oestrous synchronization in buffaloes in Sri Lanka. *Buff. J.*

1(Suppl.):105-114.

Qureshi, M. S., S. Khan, and N. Ahmad. (2007). Pregnancy depresses milk yield in dairy buffaloes. *Italian J. Anim. Sci.* **6(Suppl. 2)**:1290-93.

Rizzo, A., D Amico, P., Minoia, R., Aiudi, G. and Sciorsci, R.L. (2003). Somministrazione di $PGF_{2\alpha}$ al momento della F.A. in bovine repeat breeder. ***Atti SIRA***: 6-9.

Sauls, J.A., Voelz, B.E., Mendonça, L.G.D. and Stevenson, J.S. (2018). Additional small dose of prostaglandin $F_{2\alpha}$ at timed artificial insemination failed to improve pregnancy risk of lactating dairy cows. *Theriogenol*. **110**: 27-33.

Snedecor, G.W. and Cochran, W.G. (1994). Statistical Methods. 14th Edn. Oxford and IBH Publishing House, New Delhi, India.

Stolla, R. and Schmid, G. (1990). Effects of natural and synthetic PGF preparations on the uterine contractility of cattle. *Berl. Munch. Tierarztl. Wochenschr*. **103**:198–202.

Tsai, S. and Wiltbank, M. (1998). Prostaglandin $F_{2\alpha}$ regulates distinct physiological changes in early and mid-cycle bovine corpora lutea. *Biol. Reprod*. **58**: 346–352.

Usmani, R. H., Dailey, R. A. and Inskeep, E. K. (1990). Effects of limited suckling and varying prepartum nutrition on postpartum reproductive traits of milked buffaloes. *J. Dairy Sci*. **73**:1564-1570.

Weems, C.W., Weems, Y.S. and Randel, R.D. (2006). Prostaglandins and reproduction in female farm animals. *Vet. J*. **171**:206–28.