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Characterization of Luteal Response to PGF_{2α} Treatment During Mid-luteal Phase in Graded Murrah Buffaloes

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ABSTRACT

The present study was conducted with the objective to evaluate the functional and structural regression of corpus luteum following administration of PGF_{2α} during mid-luteal phase of estrous cycle in graded Murrah buffaloes. Healthy, pluriparous lactating and cyclic graded Murrah buffaloes (n=7; 6-8 years) were administered with PGF_{2α} (Cloprostenol sodium, 500µg) intramuscularly during mid-luteal phase of estrous cycle and recorded luteolysis (functional, structural regression) and corresponding follicular growth periodically from time of administration (0, 6, 12, 24, 48hr and 72 hr). Results showed that the significant decrease in size of CL at 24, 48hr and 72 hr, while progesterone concentration reached to its basal level (<1 ng/ml) at 12 hr of PGF_{2α} administration. Subsequently, ovulation of the existing follicle was also observed from 48 to 72 hr after administration of PGF_{2α} in buffaloes. Therefore, the present study is documented that the exogenous administration of PGF_{2α} causes the structural regression and reduced concentration of P₄ which enhances the existing follicle to become functional. Hence, exogenous administration of prostaglandin will be the most effective way of synchronization of estrus in cyclic animals thus enhancing the reproductive potential in buffaloes.

Keywords: Corpus luteum, Buffalo, Luteolysis, Progesterone, PGF_{2α}.

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INTRODUCTION

Prostaglandin F_{2α} (PGF_{2α}) preparations are used to induce luteolysis of physiological functional corpus luteum (Coffman and Pinto 2016). Corpus luteum of domestic female animals is formed from transformation of thecal cells and granulosa cells of ovulated follicles. It consists of

small and large luteal cells to secrete progesterone to support the growing early embryo followed by maintenance of pregnancy till parturition in pregnant animal, whereas in cyclical non-pregnant animals it regressed by PGF_{2α} secreted from endometrium (Wiltbank *et al.*, 2018). Luteolysis is characterised by functional retardation followed by structural regression of luteal cells (McCracken *et*

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al., 2012). During the mid-luteal phase of the estrous cycle there is a presence of mature corpus luteum controlling the follicular growth pattern which prevents the dominant follicle to end up in ovulation. After luteolysis, the estradiol is increasing trend which causes behavioural estrus signs and also exert positive feedback effect on anterior pituitary and hypothalamus for the surge of LH and GnRH respectively for effective ovulation (Kumar *et al.*, 2021). Luteolysis is completed by 48-72 hr after administration of PGF₂ α (Coffman and Pinto 2016) which allows the dominant follicle to become functional in the mid-luteal phase (Umana Sedo *et al.*, 2022). The present study is designed with the objective to evaluate the effect of exogenous administration of PGF₂ α on structural and functional regression of CL in buffaloes. Hence, the present study documented the functional and structural regression of corpus luteum following administration of PGF₂ α during mid-luteal phase of estrous cycle in a Graded Murrah buffaloes.

MATERIALS AND METHODS

The present study was conducted to evaluate the functional and structural regression of corpus luteum following administration of PGF₂ α during mid-luteal phase of estrous cycle in graded Murrah buffaloes. Healthy, lactating and regularly cycling graded Murrah buffaloes (n=7) aged between 4 and 6 years presented to the Gynaecology Section, Veterinary Clinical Complex, Veterinary College

and Research Institute, Salem, Tamil Nadu, India were utilized for the study. All the buffaloes were monitored regularly for estrus signs and cyclicity and also by frequent gynaecological examination. A real-time B-mode ultrasonography (Esaote, Italy) was used to observe follicular and corpus luteum (CL) characteristics during mid-luteal phase. The in-built caliper of the ultrasound instrument was utilized to measure the length and width of follicle and CL and the diameter was determined by taking the mean of their length and width. The mid-luteal phase was identified by ultrasonographic examination of mature CL and presence of follicles with the diameter of 15 mm and above. PGF₂ α (Pragma, Intas, India) was administered @ 500 microgram intramuscularly during mid-luteal phase of estrous cycle and functional regression of corpus luteum was recorded by estimation of progesterone concentration, whereas structural regression was assessed by measuring CL periodically at 0, 6, 12, 24, 48 hr and 72 hr. Data on area of corpus luteum, follicle and concentration of progesterone were analyzed by Student's t test, within the hours analyzed by ANOVA.

RESULTS AND DISCUSSION

The mean corpus luteum, follicular diameter and P₄ concentration during mid-luteal phase and its changes following PGF₂ α administration in seven normal cyclic lactating graded Murrah buffaloes represented in Table 1.

Table 1: The mean area of corpus luteum, largest ovarian follicular diameter with P₄ concentration at different time intervals after PGF₂ α administration in buffaloes.

S.No	Parameters	0 hr	6 hrs	12 hrs	24 hrs	48 hrs	72 hrs
1	CL (mm)	17.19 \pm 0.57 ^a	16.01 \pm 0.43 ^a	15.02 \pm 0.42 ^{ab}	13.95 \pm 0.86 ^b	10.72 \pm 0.14 ^c	7.63 \pm 0.57 ^d
2	P ₄ (ng/ml)	3.71 \pm 1.21 ^a	1.14 \pm 0.68 ^b	0.80 \pm 0.10 ^{bc}	0.69 \pm 0.03 ^{bc}	0.63 \pm 0.01 ^{bc}	0.54 \pm 0.03 ^{bc}
3	FD (dm)	7.99 \pm 0.23 ^a	8.15 \pm 0.85 ^a	8.83 \pm 0.57 ^a	9.89 \pm 0.57 ^b	10.44 \pm 0.11 ^b	6.23 \pm 0.36

Means bearing different superscript in each column (a,b,c,d) differed significantly within group at (P \leq 0.5) .

Results showed that mean corpus luteum diameter during mid-luteal phase was observed to be 17.19 \pm 0.57mm. There was a non-significant decrease in size of the CL at 6 hr, followed by significant decrease in the size at 12, 24, 48 hr and 72 hr after administration of PGF₂ α @ 500 microgram intramuscularly. The results in the present study are indicative of structural degradation of corpus luteum beginning from 12 hr after administration of PGF₂ α in buffaloes. The observations were corresponding with the reports of Monaco and Devis (2023) who also recorded increased

luteolysis during mid-luteal phase after 6 to 16 days of estrous cycle and refractory before 6 days. Functional status of CL assessed by estimation of progesterone concentration revealed that highest concentration observed at 0 hr as 3.71 \pm 1.21ng/ml, afterwards decreasing in P₄ concentration from 6 hr onwards and reached basal concentration (<1 ng/ml) from 12 hr itself, which indicative of functional degradation of corpus luteum precedes the structural degradation from 12 hours onwards. The decreasing trends in P₄ concentration was in conformity with the observation

of Wenzinger and Bleul (2012) who reported that the cows treated with prostaglandin analogue have responded with decreased trend in progesterone concentration.

Simultaneous ovarian follicles in the any one ovary during mid-luteal phase of cycle appeared as 7.99 ± 0.23 mm mean diameter before initiation of luteolytic drug administration. Slow and steady growth of follicle was observed from 6 hr onwards and reached dominance at 24 hr, pre-ovulatory stage at 48 hr. Interestingly 2 buffaloes were ovulated during 48 hr and afterwards all buffaloes were ovulated in the present study which is similar with the reports of Derar *et al.* (2012) who also reported that the buffalo heifers treated with PGF₂α has shown the follicles become ovulated. The significant decrease in the size of CL at 12hr, 24 hr, 48 hr and 72 hr correspondence with P₄ levels which has reached basal concentration (<1 ng/ml) from 12 hrs itself and the existing follicle resulted in ovulation from 48 hrs onwards after administration of PGF₂α drug in buffaloes.

CONCLUSIONS

From the present study, it may be concluded that functional changes precede the morphological changes during luteolysis. Prostaglandin treatment during the mid-luteal phase of estrous cycle resulted in better synchrony in estrus and ovulation in graded Murrah buffaloes.

CONFLICT OF INTEREST

No conflict of interest

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