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Serum Endocrine Profile in Relation to Estrus Synchronization in Surti Does

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Abstract

The serum progesterone and estradiol profiles during synchronization of estrus by buck effect and $PGF_2\alpha$ treatments were monitored in Surti does. Total eighteen non-pregnant does selected were evenly divided into 3 groups, 6 does in each group. The does of Group I were teased with a sexually-active-apronized buck; and those of Group II were treated with $PGF_2\alpha$, i.e., Inj. Lutalyse® @ 7.5 mg/doe IM twice 11 days apart, while the Group III served as untreated control. Blood samples were collected from all the animals on day 0 (before 1st $PGF_2\alpha$ injection), 3rd day (during treatment), 11th day (before 2nd $PGF_2\alpha$ injection), 14th day (after treatment) and 40th day (post-service) by jugular vein puncture. The serum separated was stored at -20°C till further analysis. In all the three groups, 83.33% does, conceived at first service in the sampling cycle. The overall mean serum progesterone concentration of Group I does (5.82±0.72 ng/ml) was significantly higher ($p<0.01$) as compared to Group II (2.93±0.38 ng/ml) and III (2.88±0.30 ng/ml). Similarly, the overall mean serum progesterone concentration of Surti does on day 0 (2.65±0.46 ng/ml), 3rd (2.56±0.80 ng/ml), 11th (4.45±0.84 ng/ml) and 14th (3.40±0.63 ng/ml) did not differ significantly, but the overall mean level at day 40 (6.31±0.45 ng/ml) was significantly ($p<0.01$) higher, because most of animals became pregnant at that time. The overall mean serum oestradiol-17β levels of Group I (24.40±2.98 pg/ml) was significantly higher ($p<0.01$) than in Group II (15.77±1.77 pg/ml) and III (12.21±1.45 pg/ml). On the other hand, the overall mean serum oestradiol-17β levels of Surti does on day 0 (12.89±1.21 pg/ml), 3rd (15.84±1.74 pg/ml), 11th (14.81±1.96 pg/ml), 14th (22.15±2.97 pg/ml) and 40th (21.64±5.16 pg/ml) did not differ significantly ($p>0.05$) and the slightly higher overall mean level found at 40th day might be the influence of the non-pregnant does at first service in the cumulative animals. The hormonal profile reflected the initiation of cyclicity and establishment of pregnancy in treated and control animals.

Key Word: Estrus synchronization, Oestradiol-17β, Progesterone, Conception, Goat.

Introduction

India stands second in the world with regard to goat population. Goat plays an important role in rural livestock as it provides livelihoods of low and medium input farmers and employment on a large scale. Hence, it is essential to improve the reproductive efficiency using different scientific

techniques in these small ruminants. Estrus synchronization plays a major role in fixed time breeding and it is essential when estrus detection is not very efficient. The value of estrus synchronization is vital in goats as the duration of both estrus cycle and estrus is variable (Rahman *et al*., 2008) and they exhibit silent estrus (Greyling and van der Nest, 2000). Estrus synchronization can be carried out by the conventional methods like alteration in the light exposure period, buck exposure and use of hormonal treatments. Evaluation of hormonal profile may be very useful to understand the endocrine response of the animals, thus improving the protocols for hormonal ($PGF_2\alpha$) and natural (buck effect) methods of synchronization of estrus. Assessment of progesterone levels during different physiological stages in female animals is considered important to determine the fertility status. Oestradiol-17β is another hormone that plays a major role is reproductive physiology of a female. Sporadic information is available regarding changes in serum oestradiol-17β and progesterone levels during estrus and thereafter in goats (Pathak *et al*., 1992; Leyva-Ocariz *et al.,* 1995). Therefore, the present study was undertaken to examine the changes in concentration of these hormones during estrus following synchronization by $PGF_2\alpha$ and buck effect in Surti goats.

Materials and Methods

Selection of Surti does was done at random in the University farm and eighteen non-pregnant doe were separated from the flock by ultrasonographic visualization. The animals were equally divided into 3 groups, each group consisting 6 does. The does of treatment group T1 were teased with a sexually-active-apronized buck; the does of treatment group T2 were treated with $PGF_2\alpha$, i.e. Inj. Lutalyse® @ 7.5 mg/doe IM at 0 day and 11th day, and control group T3 was kept without any treatment. The does were maintained on optimum nutritional, health care and other managemental practices as per routine farm schedule. Onset and duration of estrus were recorded for each doe in all groups and 3 bucks were allowed to mate with the does. Blood samples (5 ml) were collected from all the animals on day 0 (before 1st $PGF_2\alpha$ injection), 3rd day (during treatment), 11th day (before 2nd $PGF_2\alpha$ injection), 14th day (after treatment) and on 40th day (post-service) aseptically by jugular vein puncture. The serum was separated by standard procedure and stored at -20°C till further analysis. Serum progesterone (P_4) and oestradiol (E_2) concentrations were measured by standard Enzyme Linked Immuno Sorbent Assay (ELISA) technique using assay kits and procedure described by Diagnostic Automation/Cortez Diagnostics Inc., California, USA. The test of significance among and within the groups for progesterone (P_4) and oestradiol (E_2) profile was made by analysis of variance (ANOVA) and the mean differences between and within the groups were tested using Duncan's multiple range test (DNMRT) at 5 % level of significance.

Result and Discussion

Serum progesterone concentration

The overall mean serum progesterone concentration of T1 group was significantly higher ($p<0.01$) as compared to T2 and T3 groups. Similarly, the overall mean serum progesterone levels of Surti does at day 0, 3, 11 and 14 did not differ significantly ($p>0.01$) while, overall mean serum progesterone levels at day 40 differed significantly ($p<0.01$) because most of the animals became pregnant at that time.

Prior to introducing the buck in T1 group, the mean serum progesterone concentration at 0 day was found to be 4.26±0.85 ng/ml and little bit fluctuation 4.26±2.31 ng/ml was seen at 3rd day and again increased non-significantly ($p>0.05$) at 11th day and decreased at 14th day and finally increased at 40th day. The trend found in this group might be due to most of the does would be at different days of luteal phase during teasing period of first 1 to 11 days and thereafter within 3 days four does were found in heat. The mean serum progesterone concentrations prior to treatment in T1 (buck effect), T2 (PGF2α treatment) and T3 (control) groups were found as 4.26±0.85, 2.23±0.65 and 1.47±0.46 ng/ml, respectively, which were little lower than those reported by Islam *et al*. (2012) in local goat.

Table 1: Serum progesterone concentration (ng/ml) at different time intervals/days in treatment and control groups of Surti does (Mean ± SEM)

Time intervals / Days	Groups / Treatments (n = 6)			Overall	F value	P value
	T1 (Buck Effect)	T2 ($PGF_2\alpha$ Treatment)	T3 (Control)			
0 day (before treatment)	$4.26\pm0.85b^{w}$	$2.23\pm0.65a^{w}$	$1.47\pm0.46a^{w}$	2.65 ± 0.46^{w}	4.60*	0.02
3rd day (during treatment)	$4.26\pm2.31a^{w}$	$1.27\pm0.46a^{w}$	$2.15\pm0.29a^{wx}$	2.56 ± 0.80^{w}	1.25	0.31
11th day (during treatment)	$8.11\pm1.63b^{w}$	$2.86\pm0.59a^{w}$	$2.36\pm0.14a^{wx}$	4.45 ± 0.84^{w}	10.02**	0.00
14th day (after treatment)	$4.62\pm1.76a^{w}$	$2.53\pm0.39a^{w}$	$3.04\pm0.53a^{x}$	3.40 ± 0.63^{w}	1.00	0.39
40th day (post service)	$7.82\pm0.48b^{w}$	$5.75\pm0.95ab^{x}$	$5.37\pm0.52a^{y}$	6.31 ± 0.45^{x}	3.66*	0.05
Overall	5.82±0.72b	2.93±0.38a	2.88±0.30a	3.87±0.32	11.08**	0.00
F value	1.61	6.92**	13.00**	5.63**	--	--
P value	0.20	0.00	0.00	0.00	--	--

Means bearing different superscripts within a column (between time intervals/days; w,x,y) and those within a row (between the groups; a,b) differ significantly (*p<0.05 & ** p<0.01).

In the present study, in group T2 the progesterone level decreased at 3rd day (1.27±0.46 ng/ml) which might be attributed to $PGF_2\alpha$ that causes lysis of CL by obstructing the blood supply, the progesterone level in serum falls rapidly reaching basal level on the day of estrus as reported in dwarf goat by Khanum *et al.* (2008). At 14th day in T2 group, mean serum progesterone concentration was slightly increased as 3.04±0.53 ng/ml than that found at 11th day. Since no perusal of literature available to compare such kind of trend but that might be due to only three does that came in heat with first $PGF_2\alpha$ injection and rest did not responded to this $PGF_2\alpha$ treatment.

The mean serum progesterone concentration at 40th day post-service in T1, T2 and T3 groups were found to be 7.82±1.79, 5.75±0.95 and 5.37±0.52 ng/ml, respectively and overall mean serum progesterone concentration at 40th day post-service was 6.31±0.45 ng/ml. This could be attributed to most of the does conceived in each groups. The overall mean serum progesterone concentration was in close agreement with 6.22±0.8 ng/ml on the day 21 of normal gestation in Assam local goat reported by Bonia *et al*. (2015).

Serum oestradiol-17β concentration

The overall mean serum oestradiol-17β concentration of T1 group was significantly higher (p<0.01) than T2 and T3 groups. On the other hand, the overall mean serum oestradiol-17β levels of Surti does at day 0, 3, 11, 14 and 40 did not differ significantly (p>0.05) and the slight higher overall mean serum oestradiol-17β level found at 40th day (21.64±5.16 pg/ml) might be due to the influence of the non-pregnant does at first service in the cumulative animals.

The mean serum oestradiol-17β concentration prior to treatment in T1, T2 and T3 groups were found at basal level confirming the various days of luteal phase in these does (Table 2). At 0 day in buck effect (T1 group) the mean serum oestradiol-17β level was found 14.78±1.65 pg/ml and thereafter steady increasing trend was observed at 3rd day, 11th day, 14th day and 40th day, which might be due to presence of buck influencing onset of pro-estrus and estrus phase in this group

Table 2: Serum oestradiol-17β (E_2) concentration (pg/ml) at different time intervals/days in treatment and control groups of Surti does (Mean ± SEM)

Time intervals / Days	Groups / Treatments (n = 6)			Overall	F value	P value
	T1 (Buck Effect)	T2 ($PGF_2\alpha$ Treatment)	T3 (Control)			
0 day (before treatment)	$14.78\pm1.65a^{w}$	$12.65\pm2.57a^{w}$	$11.24\pm2.08a^{w}$	12.89 ± 1.21^{w}	0.70	0.51
3rd day (during treatment)	$15.36\pm1.34a^{wx}$	$16.51\pm2.83a^{w}$	$15.66\pm4.58a^{w}$	15.84 ± 1.74^{w}	0.03	0.96
11th day (during treatment)	$17.39\pm4.70a^{wx}$	$14.52\pm1.94a^{w}$	$12.51\pm3.29a^{w}$	14.81 ± 1.96^{w}	0.49	0.62
14th day (after treatment)	$31.03\pm3.71b^{xy}$	$23.72\pm5.39ab^{w}$	$11.69\pm3.06a^{w}$	22.15 ± 2.97^{w}	5.48*	0.02
40th day (post service)	$43.46\pm9.56b^{y}$	$11.46\pm4.95a^{w}$	$9.98\pm3.51a^{w}$	21.64 ± 5.16^{w}	8.37**	0.00
Overall	24.40±2.98b	15.77±1.77a	12.21±1.45a	17.46±1.35	8.33**	0.00
F value	5.98**	1.63	0.39	1.99	--	--
P value	0.00	0.20	0.81	0.10	--	--

Means bearing different superscripts within a column (between time intervals/days; w,x,y) and those within a row (between the groups; a,b) differ significantly (* $p<0.05$ & ** $p<0.01$).

and sudden increase at 14th day could be due to four does found on heat period and at 40th day high mean serum oestradiol-17β level might be attributed to sum of basal level of natural estrogen from pregnant does along with high level of estrogen from rest of non-pregnant does. The FSH is secreted from pituitary by the action of GnRH in does teased with buck, as the buck effect stimulates GnRH pulse generator in hypothalamus. Thus, the oestradiol-17β is secreted from the Graafian follicle by the action of FSH hormone (Islam *et al*. 2012).

In T2 group, the oestradiol-17β level was observed to be 12.65±2.57 pg/ml at 0 day and that increased non-significantly ($p>0.05$) to 16.51±2.83 pg/ml and 23.72±5.39 pg/ml at 3rd day and 14th day post-treatment, respectively. This might be due to influence of $PGF_2\alpha$ treatment on luteal tissue and starting recruitment of new follicles. As a result the progesterone level falls and unblocks the FSH secretion. The secretion of FSH causes growth and development of the Graafian follicle and the oestradiol-17β is secreted from the granulosa and theca cells of follicle (Ishwar and Pandey, 1992). Moreover, at 14th day (3rd day after second $PGF_2\alpha$ injection) in T2 group mean serum oestradiol-17β concentration was observed to be 23.72±5.39 pg/ml, which was in agreement with 22.25±0.07 pg/ml during fertile heat in Surti goat (Anonymous, 2012) and 28.00 ± 6.0 pg/ml during the follicular phase on 0 day, 22.30±4.2 pg/ml on 19th day of cycle and 24.00 5.0 pg/ml on the day of estrus, respectively in crossbred (Alpine X Nubian) and native goats (Leyva-Ocariz *et al.,* 1995). The differences reported in oestradiol-17β concentration by various workers at various days could be attributed to variation in breed, species, nutritional, reproduction and health status of animals, apart from seasonal and analytical differences during different phase of estrus with $PGF_2\alpha$ injection, buck effect and without any influence in control group of does.

The changes in serum oestradiol-17β and progesterone concentrations Surti goats following estrus synchronization by $PGF_2\alpha$ and buck effect revealed that the buck effect was as effective as $PGF_2\alpha$ treatment for synchronization of estrus in local goats.

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Conflict of Interest: Authors declare no conflict of interest for this research work.

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