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Effect of serum cortisol levels during winter and summer seasons on kidding rate in Tellicherry goats

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Abstract
An experiment was conducted on serum cortisol level during winter and summer seasons in Tellicherry goats. Out of 240 Tellicherry does, 120 does during winter season and the remaining 120 does during summer season. The selected does of each season were divided into six experimental groups *viz*., Groups I, II, III, IV, V (Treatment groups) and VI (Control group). In Group I, the selected does were synchronized with intravaginal sponge method. In group II, all the does were treated with ovsynch protocol. In group III, does were treated with ovsynch protocol along with progesterone intravaginal sponge. The does of group IV were subjected to co-synch protocol which was similar to Ovsynch protocol except that breeding was done at the time of 2nd GnRH injection. In group V, does were treated with Co-synch protocol along with progesterone intravaginal sponge. The does of group VI were observed for oestrus from the time of selection during each season and were bred by NS or AI during the observed oestrus. During winter and summer seasons there was a significant difference in the mean cortisol levels between pregnant and non-pregnant does at all stages of blood collection. At the time of breeding the cortisol level in non-pregnant does were significantly ($P \leq 0.05$) higher than pregnant does in all the groups.

Keywords: Cortisol, synchronized, progesterone, Ovsynch, Co synch, GnRH

Introduction
Goat production is experiencing a period of worldwide growth. This growth has intensified in recent decades, especially in developing countries, which hold the largest flocks. Even though, the goats are polyoestrus, they do not express clear-cut signs of oestrus, as seen in cows and are mated arbitrarily. Further, it is not possible to obtain uniform kidding distribution throughout the year using natural oestrus as the oestrus behaviour is not expressed properly during hot summer (Pietroski *et al*., 2013) [5]. Numerous studies in bovines indicated that the pregnancy rates to the Ovsynch / Co-synch program were comparable and in some studies greater than the appropriate control group. But such studies are lacking in goats especially in Tellicherry breed. Plasma cortisol interfered the follicular phase by suppressing the development of high frequency pulse which compromise the preovulatory estradiol rises and LH-FSH surges. (Breen *et al*. 2004) [2]. Cortisol acts centrally to suppress pulsatile GnRH secretion in follicular phase in cow (Gentry, 2002) [3] and ewes (Breen *et al*., 2004) [2]. Hence, with the above points in view, the present investigation has been undertaken in Tellicherry goats with the following objective.
To estimate serum cortisol concentrations in various phases of synchronization of ovulation protocol during winter and summer seasons in Tellicherry goats.

Materials and Methods
A total of 240 does were utilized for this study. Out of 240 does, 120 does were during winter season (from October to January) and the remaining does were treated during summer season (from April to July). The selected does divided into six experimental groups *viz*., Groups I, II, III, IV, V (Treatment groups) and VI (Control group) and hence, each group consisted of 20 does. In Group I, does were inserted with intravaginal sponges for 9 days. One day before sponge withdrawal (day 8) 250 µg of $PGF_2\alpha$ and on the day of sponge removal (day 9) 300 IU of eCG were given intramuscularly. In group II, does were treated with ovsynch protocol which consisted of an intramuscular injection of 10 µg of GnRH on the day of start of synchronization of ovulation (day 0), 250 µg of $PGF_2\alpha$ seven days later (day 7) and another 10 µg of GnRH (2nd GnRH) at 48 hours after the $PGF_2\alpha$ injection (day 9).

In group III, does treated with ovsynch protocol along with progesterone intravaginal sponge between day 0 and 7. The does of group IV were subjected to co-synch protocol which was similar to ovsynch protocol except that breeding was done at the time of 2nd GnRH injection. In group V, does were treated with co-synch protocol along with progesterone intravaginal sponge between day 0 and 7. The does of group VI were observed for oestrus from the time of selection during each season and were bred by NS or AI during the observed oestrus.

After the second GnRH injection in groups II to V and sponge removal in group I, all the does in each treatment were equally divided into 2 sub-groups. The does of one sub group in each of these groups were bred by NS and the other sub group does were artificially inseminated. NS or AI was done at 16-18 hours after the second GnRH injection in groups II and III and at the time second GnRH injection in groups IV and V and at 60 hours after sponge removal in group I. In control group (group VI), 10 does were allowed for NS and the remaining 10 does were artificially inseminated during the observed oestrus in each season.

The blood collection was done in group I at sponge insertion, sponge removal, at NS or AI and 10 days following NS/AI. In groups II, III, IV and V blood collection was done at first GnRH injection, at the time of PGF2α injection, at the time of NS or AI and 10 days followed NS or AI and in group VI at natural oestrus and 10 days after NS or AI. The serum was separated and estimated by 125I-labelled gamma counter.

Results and Discussion

The mean serum cortisol levels (ng/ml) before, during and after synchronization of ovulation protocols during winter and summer seasons were presented in Table I and 2. The mean serum cortisol levels (ng/ml) in goats during winter ranged from 12.97 ± 0.19 to 19.31 ± 0.40 ng/ml and it ranged from 21.12 ± 0.22 to 27.66 ± 0.10 ng/ml in summer. These results were in accordance with the findings of Khan and Ludri (2001). However, Ali (2014) [1] and Sukanta Mondal *et al*. (2016) [9] reported higher levels of cortisol (24-32 ng/ml) in goats. But low levels of plasma cortisol from 3.53 ± 2.08 to 5.34 ±1.63 ng/ml was reported by Sikka *et al*. (1992)8 in buffaloes. The elevated mean serum cortisol concentration during all the stages of estimation in all the groups during summer in this study indicated the summer stress in goats. It could be the reason for reduced kidding rate in summer than winter as described by Singh *et al*. (2000) [7] in buffloes. In both the seasons, the mean serum cortisol concentration was lower in pregnant does than in non-pregnant does.

The elevated cortisol might have suppressed the ovarian function (Roth *et al*., 2000) [6] or caused embryonic mortality (Wise *et al*., 1988)10 in these goats and ultimately resulted in failure of kidding. The elevated serum cortisol due to summer stress found to be detrimental to the conception, embryonic development and subsequent kidding rate in Tellicherry goats.

Table 1: Mean (±se) serum cortisol level (ng/ml) at various stages of synchronization of ovulation during winter season

S. No	Treatment groups		Sponge insertion	Sponge withdrawal	Breeding	10 days after breeding
1.	Group I (Vaginal sponge)	P	14.97 ± 0.25^{a}	17.00±0.22	15.01±0.14^{a}	14.14±0.09^{a}
		NP	18.34 ± 0.16^{b}	16.99±0.85	19.31±0.40^{b}	16.93±0.24^{b}
Treatment groups			**I stGnRH**	**At PGF$_{2}$α**	**Breeding**	**10 days after breeding**
2.	Group II (Ovsynch)	P	15.12±0.32^{a}	14.14±0.14^{a}	15.18±0.23^{a}	13.21±0.17^{a}
		NP	18.12±0.23^{b}	18.05±0.00^{b}	18.70±0.32^{b}	16.41±0.19^{b}
3.	Group III (Ovsynch + Sponge)	P	14.06±0.16^{a}	14.62±0.12^{a}	13.35±0.13^{a}	12.97±0.19^{a}
		NP	16.11±0.22^{b}	17.24±0.23^{b}	16.33±0.08^{b}	17.21±0.06^{b}
4.	Group IV (Co-synch)	P	14.98±0.17^{a}	14.11±0.09^{a}	15.97±0.14^{a}	14.24±0.23^{a}
		NP	17.18±0.05^{b}	18.29±0.07^{b}	19.18±0.10^{b}	18.18±0.07^{b}
5.	Group V (Co-synch+ sponge)	P	15.00±0.22^{a}	14.56±0.12^{a}	15.99±0.19^{a}	14.16±0.10^{a}
		NP	18.09±0.36^{b}	19.09±0.25^{b}	17.13±0.29^{b}	16.27±0.13^{b}
6	Group VI (Control)	P	-	-	15.98±0.19^{a}	13.12±0.13^{a}
		NP	-	-	18.13±0.22^{b}	16.37±0.04^{b}

Mean values bearing different superscripts (a, b, c, d) in winter season among different days of blood collection between row differ significantly ($P \leq 0.05$). P – Pregnant Does, NP- Non- Pregnant Does.

Table 2: Mean (±se) serum cortisol level (ng/ml) at various stages of synchronization of ovulation during summer season

S. No	Treatment groups		Sponge insertion	Sponge withdrawal	Breeding	10 days after breeding
1.	Group I (Vaginal sponge)	P	22.60 ± 0.45^{a}	21.99 ± 0.37^{a}	24.07 ± 0.27^{a}	22.26 ± 0.34^{a}
		NP	24.13 ± 0.32^{b}	25.12 ± 0.31^{b}	27.66 ± 0.10^{b}	25.35 ± 0.31^{b}
Treatment groups			**I stGnRH**	**At PGF$_{2}$α**	**Breeding**	**10 days after breeding**
2.	Group II (Ovsynch)	P	22.09 ± 0.30^{a}	22.25 ± 0.14^{a}	23.98 ± 0.31^{a}	22.43 ± 0.15^{p}
		NP	25.35 ± 0.35^{b}	26.00 ± 0.20^{b}	25.19 ± 0.33^{b}	23.06 ± 0.22^{p}
3.	Group III (Ovsynch + Sponge)	P	21.24 ± 0.23^{a}	22.50 ± 0.17^{a}	21.06 ± 0.23^{a}	20.31 ± 0.19^{a}
		NP	23.42 ± 0.17^{b}	25.02 ± 0.25^{b}	24.19 ± 0.16^{b}	23.44 ± 0.17^{b}
4.	Group IV (Co-synch)	P	21.16 ± 0.25^{a}	22.25 ± 0.18^{a}	22.09 ± 0.20^{a}	21.85 ± 0.31^{a}
		NP	24.21 ± 0.23^{b}	25.19 ± 0.19^{b}	25.14 ± 0.23^{b}	24.10 ± 0.22^{b}
5.	Group V (Co-synch+ sponge)	P	22.69 ± 0.45^{a}	21.12 ± 0.22^{a}	21.18 ± 0.23^{a}	21.67 ± 0.29^{a}
		NP	24.00 ± 0.19^{b}	23.02 ± 0.17^{b}	23.00 ± 0.16^{b}	24.20 ± 0.27^{b}
6	Group VI (Control)	P	-	-	21.96 ± 0.26^{a}	22.05 ± 0.42
		NP	-	-	25.14 ± 0.20^{b}	23.00 ± 0.12

Mean values bearing different superscripts (a, b, c, d) in summer seasons among different days of blood collection between row differ significantly ($P \leq 0.05$). P – Pregnant Does, NP- Non- Pregnant Does.

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