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Synchronization of oestrus by 'buck effect' and $PGF_2\alpha$ treatment in local indigenous goats

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ABSTRACT

The study was carried out to investigate the influence of buck effect and $PGF_2\alpha$ treatment on oestrus synchronization in local indigenous goats. Apparently healthy normally cycling nulliparous goats (16) were divided into 3 groups considering their age, body weight and serum progesterone concentration indicating their similar stage of oestrous cycle prior to treatment. The group 1 (control, n=4) was kept separate without treatment, the group 2 (T_1, n=6) was treated with 2 injections of $PGF_2\alpha$ at 11 days apart @ 7.5mg/animal/injection while the group 3 (T_2, n=6) was teased with a sexually-active-aproned buck. The proportion of females showing behavioural oestrus was successfully synchronized by double injection of $PGF_2\alpha$ at 11 days apart, as well as by male introduction in T_1 and T_2 groups, respectively. The time interval between start of treatment and onset of oestrus were significantly shorter in T_1 (64.00±3.35 h) and T_2 (65.00±18.50 h) than in control (264±30.24 h) group but was similar in both T_1 and T_2. However, the duration of oestrus was 30.5±1.5 h, 34.00±3.69 h and 30.00±4.38 h for control, T_1 and T_2 groups, respectively. There was no significant difference in conception rates amongst the groups. All the goats conceived after second service irrespective of treatment groups. It was found that the buck effect appeared to be as effective as conventional $PGF_2\alpha$ treatment in indigenous goats for synchronization of oestrus.

Key words: Buck effect, Goat, $PGF_2\alpha$, Synchronization

Oestrus synchronization has been successfully used in enhancing reproductive efficiency, particularly in small ruminants (Kusina *et al.* 2000). Oestrus synchronization in does can be achieved either by reducing the length of the luteal phase of oestrous cycle with prostaglandin $F_2\alpha$ ($PGF_2\alpha$) and its analogues (Jainudeen *et al.* 2000) or by extending it artificially with exogenous progesterone (Karatzas *et al.* 1997). These hormonal treatments are not easily available or are too much expensive for the farmers in developing countries like India. Therefore, it requires development of managemental strategies such as pheromones and biostimulations.Induction of synchronous oestrus behaviour and ovulation in anovulatory females after introduction of buck is called the buck effect (Ungerfeld *et al*. 2004). This response is widely used to advance and synchronize breeding in goats (Veliz *et al.* 2002). The 'buck effect' is now one of the well established means of manipulating goat reproduction without using much criticized hormonal therapy. The objective of the present study was to determine the influence of 'buck effect' and $PGF_2\alpha$ administration on oestrus synchronization in local indigenous goats.

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MATERIALS AND METHODS

Apparently healthy, normally cycling nulliparous goats (16) were selected on the basis of age (15.38±0.96 months) and body weight (13.63±0.58 kg). There was no significant difference of age and body weight among the groups. Pre-treatment serum progesterone concentration was estimated to ensure similar stage of oestrous cycle in all experimental groups. The experimental animals were maintained under stall-fed condition and housed in separate sheds, each attached with open paddock. Experimental animals were fed with cultivated green fodders and concentrate feed. Does and buck were daily fed with 250 g and 300 g of concentrate, respectively as per routine feeding system of the farm. The breeding of animals is usually done during Nov-Jan at this farm. Experimental animals were divided into 3 groups of 4 in control and 6 each in first treatment (T_1) and second treatment (T_2). The control group was kept separate without any treatment; T_1 group was treated with 2 injections of

$PGF_2\alpha$ (dinoprost tromethamine) at 11 days apart @ 7.5mg/animal/injection, while in T_2 group, a sexually active buck was introduced and allowed to stay with does continuously day and night till all the does shown behavioural oestrus. The buck was aproned to prevent undesired mating. Heat detection was done by teaser buck in control and T_1 group and by the same buck kept with does in T_2 group daily at 6 h interval, i.e., at 04:30 h, 10:30 h, 16:30 h and 22:30 h. Onset of oestrus and duration of oestrus were recorded for each doe in all groups and 3 bucks were allowed to mate with the does. The time interval (h) between onset of oestrus and the treatment was calculated by taking difference between the recorded date and time of starting the experiment and first incidence of one or more behavioural activity characteristic to females in oestrus. While the duration of oestrus (h) was calculated by taking difference between the recorded time of onset and end of oestrus. The does were considered to be at oestrus by observing two main signs i.e. does allowing buck to mount and vigourous wagging of tail. Similarly, the end of oestrus was considered when mounting by male was not allowed and there was no wagging of tail. Conception rates were calculated on the basis of non-return rate and serum progesterone level.

Blood samples were collected daily starting from a day prior to treatment till exhibition of oestrus and at an interval of 4 days for 10 consecutive days thereafter i.e. till 40 days post-mating. Sampling was done between 8 AM to 11 AM daily in all the experimental females. Serum samples were separated and stored at –20ºC till hormonal assay. Serum progesterone was estimated by RIA using standard diagnostic kit.

The general linear model of one way ANOVA was used for analyzing continuous data as per the procedure outlined in SPSS® 11.00 statistical packages. The difference among the percentages and frequencies were tested using nonparametric test (Chi-square test).

RESULTS AND DISCUSSION

The effect of treatments on synchronization of oestrus, oestrus onset, oestrus duration and conception rates were shown in Table.1. The results revealed that the proportion of females shown behavioural oestrus was successfully synchronized by double injection of $PGF_2\alpha$ at 11 days apart as well as by buck effect in T_1 and T_2 groups respectively. The $PGF_2\alpha$ treatment and buck effect induced behavioural oestrus, respectively in 83.3% (5 out of 6) and 50.0% (3 out of 6) cyclic does within 72 h of treatments. Remaining 1 doe in T_1 group and 3 does in T_2 group shown behavioural oestrus between 72–120 h of treatment while all the does (4 out of 4) in control group shown behavioural oestrus after 120 h. The oestrus synchronization response in T_1 group was consistent with observations reported by others (Alvarez *et al.* 2010, Vazquez *et al.* 2010 and Ahmed *et al.* 1998). However, Perera *et al.* (1978) and Taylor (1978) reported 83.33% and 100% synchronization of oestrus by $PGF_2\alpha$ treatment in very short time with a range of 18–23 and 24–48 h, respectively. In T_2 group, 100% synchronization of oestrus (between 14–116 h) was in agreement with Keskin (2003). However, the maximum time taken to synchronize oestrus in all the does was lower in the present study. The buck effect had been shown as a multi-sensory phenomenon involving olfactory, visual, tactile and auditory cues. High% of females responds to male stimulation when all cues are active (Chemineau 1987). The gonadotropin-releasing hormone (GnRH) pulse generator generated intermittent GnRH discharges into the portal vessels and thereby regulated the pulsatile LH secretion into the peripheral circulation (Karsch 1984). Therefore, the central target of the buck effect pheromone was thought to be the hypothalamic GnRH pulse generator.

Table 1. Effect of $PGF_2\alpha$ treatment and buck introduction on oestrus response and synchronization in cyclic does

Attributes	Control	T_1	T_2
No of does treated	4	6	6
Does showing behavioural oestrus ($\chi 2$ value 0.02)	4^a(100)	6^b(100)	6^b(100)
Degree of oestrus synchronization			
Up to 72 h (χ^2 value 0.25)	-	5^a (83.33)	3^b (50.00)
72 to 120 h (χ^2 value 0.25)	#	1^a (16.66)	3^b (50.00)
Oestrus response			
Onset of oestrus(h)	264^b±30.24	64.00^a±3.35	65.00^a±18.50
Duration of oestrus(h)	30.5±1.5	34.00±3.69	30.00±4.38
Conception rate			
At first service ($\chi 2$ value 0.33)	3^a (75)	4^b (66.66)	5^c (83.33)
At second service ($\chi 2$ value 0.33)	1^a (25)	2^b (33.33)	1^a (16.66)

Figures with different superscripts in a row differ significantly ($P<0.05$) for oestrus response and against respective $\chi 2$ value (in parentheses) for frequency data. Figures in parenthesis indicate percentages. # All the control females exhibited oestrus after 120 h of start of treatments in other groups.

The average time interval between start of treatment and onset of oestrus was significantly shorter in T_1 (64.00±3.35 h) and T_2 (65.00±18.50 h) than in control (264.5±30.24 h) group. The mean duration for onset of oestrus in T_1 group was similar to reports of others (Vazquez *et al.* 2010, Alvarez *et al.* 2010 and Amaranditis *et al.* 2004). However, the interval reported by Pandey *et al.* (1985) and Greyling and Van Niekerk (1991) was longer than the present findings. The onset of oestrus in T_2 group was in agreement with Keskin (2003).

Onset and end of oestrus was considered to be 3 h less than the first time of two consecutive detections and non-detections, respectively (Dhali *et al.* 2005). The duration of oestrus was 30.5±1.5 h, 34.00±3.69 h and 30.00±4.38 h for

control, T_1 and T_2 groups, respectively (Table 1). Although there was no significant difference between the groups, the oestrus duration was more in T_1 group which might be due to exogenous hormonal treatment. The results obtained in the present study corroborated with the earlier findings (Sahni and Roy 1976, Greyling and Van Niekerk 1991). However, the duration of oestrus was observed shorter by Pandey *et al*. (1985), Ishwar and Pandey (1992) and Akusu and Egbunike (1984) while longer duration was observed by Amaranditis *et al.* (2004). The nonsignificant difference in the oestrus duration among all the groups in present study suggested that $PGF_2\alpha$ or buck effect did not interfere with the duration of oestrus. The progesterone concentration remained at basal levels (<1ng/ml) during the oestrus, as observed by others (Pathak *et al.* 1992, Nandy *et al.* 2001 and Khadiga *et al.* 2005).

There was no significant difference in conception rates between the groups. The conception rate was calculated on the basis of two services. After first service, the maximum conception rate was observed in T_2 group (83.3%) followed by control group (75%) and T_1 group (66.7%) while the remaining 25%, 33.3% and 16.7% in control, T_1 and T_2 groups, respectively conceived after second service. Overall 100% does in all the groups conceived after second service. The conception rate of T_1 group (66.7%) was in agreement with Hearnshaw *et al.* (1974) and Serna *et al.* (1978) who got 56 and 71.4% conception rate, respectively, following synchronization of oestrus by $PGF_2\alpha$ analogue. However, the higher conception rates were observed by Pandey *et al.* (1985) and Akusu and Egbunike (1984). The results of present investigation showed 83.33% conception rate, which was in agreement with Chemineau (1983) who reported 81% conception rate in goats cycling before introduction of male. Higher conception rate after first service was observed in T_2 group which might be due to continuous presence of male, which prepared the female to get ready to mate and conceive under the most natural social conditions. Overall serum progesterone concentration for control, T_1 and T_2 group over 40-days post-mating was 6.88±0.61, 7.34±0.52 and 6.05±0.57 ng/ml, respectively, which confirmed the conception rates.

Thus, it can be concluded from the present study that the buck effect appears to be as effective as conventional $PGF_2\alpha$ treatment in indigenous goats for synchronization of oestrus without any extra input.

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REFERENCES

Ahmed Muna M M, Makawi S E and Jubara A S. 1998. Synchronisation of oestrus in Nubian goats. *Small Ruminant Research* **30**: 113–20.

Akusu M O and Egbunike G N. 1984. Fertility of the West-African Dwarf goat in its native environment following PGF_2a induced oestrus. *Veterinary Quarter* **6** (3): 173–76 (Abst).

Alvarez L, Arvizu R R, Luna J A and Zarco L A. 2010. Social ranking and plasma progesterone levels in goats. *Small Ruminant Research* **90**: 161–64.

Amaranditis I, Karagiannidis A, Saratsis Ph and Brikas P. 2004. Efficiency of methods used for estrus synchronization in indigenous greek goats. *Small Ruminant Research* **52**: 247–52.

Chemineau P. 1983. Effect of oestrus and ovulation of exposing Creole goats to the male at three times of the year. *Journal of Reproduction and Fertility* **67**: 65–72.

Chemineau P. 1987. Possibilities for using bucks to stimulate ovarian and oestrous cycles in anovulatory goats - a review. *Livestock Production Science* **17**: 135–47.

Dhali A, Mishra D P, Karunakaran M, Mech A and Rajkhowa C. 2005. Influence of plasma oestradiol-17ß and progesterone levels on oestrus behaviour in mithun (*Bos frontalis*). *Applied Animal Behaviour Science* **49** (3): 196–99.

Greyling J P C and Van Niekerk C H. 1991. Different synchronization techniques in Boer goat does outside the normal breeding season. *Small Ruminant Rsearch* **5**: 233–43.

Hearnshaw H, Restall B J, Nancarrow C D and Mattner P E. 1974. Synchronization of oestrus in cattle, sheep and goat using a prostaglandin analogue. *Proceedings of Australian Society of Animal Production* **10**: 242–45.

Ishwar A K and Pandey J N. 1992. Oestrus synchronization and fertility in Black Benegal goats following administration of progesterone and gonadotrophins. *Researches in Veterinary Sciences* **52** (2): 141–46.

Jainudeen M R, Wahid H and Hafez E S E. 2000. Sheep and Goats. *Reproduction in Farm Animals.* Pp.172–181. (Eds) Hafez B and Hafez E S E. Williams and Wilkins, Philadelphia, USA.

Karatzas G, Karagiannidis A, Varsakeli S and Brikas P. 1997. Fertility of fresh and frozen-thawed goat semen during the non-breeding season. *Theriogenology* **48**: 1049–59.

Karsch F J. 1984. The hypothalamus and anterior pituitary gland. *Reproduction in Mammals: **3.** Hormonal Control of Reproduction.* 2nd edn, Pp. 1–20. (Eds) Austin C R, Short R V. Cambridge University Press.

Keskin M. 2003. Influence of buck effect and exogenous hormone treatments on oestrus synchronization and litter size in Shami (Damascus) goats. *Turkish Journal of Veterinary and Animal Science* **27**: 453–57.

Khadiga M G, Mohamed K G and Doaa F T. 2005. The hormonal profile during the oestrus cycle and gestation in Dmascus goats. *Small Ruminant Research* **57**: 85–93.

Kusina N T, Tarwirei F, Hamudikuwanda H, Agumba G and Mukwena J. 2000. A comparison of the effects of progesterone sponges and ear implants, $PGF_2\alpha$, and their combination on efficiency of oestrus synchronization and fertility of Mashona goat does. *Theriogenology* **53**: 1567–80.

Mishra H R and Biswas S C. 1974. A study on distribution of oestrus in deshi goats. *International Goat and Sheep Research* **19**: 132–34.

Nandy D K, Kumar Puneet and Singh Khub. 2001. Reproductive behaviour of goat in different seasons. *International Journal of*

Animal Science **16** (1): 167–70.

Pandey J N, Ishwar A K and Singh R A. 1985. Oestrous synchronization in goats using prostaglandin (Lutalyse). *Indian Journal of Animal Sciences* **55** (7): 551–52.

Pathak M M, Patel A V, Jaiswal R S, Mehta V M and Janakiraman K. 1992. Circulating hormone levels in cyclic goats. *Proceedings and Papers presented at V International Conference on Goats: Recent Advances in Goat Production.* IGA, IDRC, FAO, ISGP and Fodder Production Project, 2–8 March, 1992, pp.1383–87, New Delhi, India.

Perera B M A O, Bongso T A and Abeynaike P. 1978. Oestrus synchronisation in goats using cloprostenol. *Veterinary Record* **102**: 314.

Sahni K L and Roy A. 1976. A study of the sexual activity of the Barbary goat and conception rate through AI. *Indian Journal of Veterinary Science* **37**: 269–76.

Serna J A, Bosu W J K and Barker C A V. 1978. Sequencial administration of cronolone and $PGF_2\alpha$ for oestrus synchronization in goats. *Theriogenology* **9**: 177–85.

SPSS. 2001. SPSS® *User's Guide*: Release 11.0.0 edn. SPSS Inc., USA.

STATS. 1998. STATS™ *User's Guide*: Release Version 1.1. Dicision Analyst, Inc. USA.

Taylor D J W. 1978. Oestrus synchronization in goats. *Veterinary Record* **17**: 390.

Ungerfeld R, Forsberg M and Rubianes E. 2004. Overview of the response of anoestrous ewes to the male effect. *Reproduction, Fertility and Development* **16**: 479–90.

Vazquez M I, Blanch M S, Alanis G A, Chaves M A and Gonzalez-Bulnes A. 2010. Effects of treatment with a prostaglandin analogue on developmental dynamics and functionality of induced corpora lutea in goats. *Animal Reproduction Science* **118**: 42–47.

Veliz F G, Moreno S, Duarte G, Vielma J, Chemineau P, Poindron P, Malpaux B and Delgadillo J A. 2002. Male effect in seasonally anovulatory lactating goats depends on the presence of sexually active bucks, but not estrous females. *Animal Reproduction Science* **72**: 197–207.