



## Effect of different Estrus Synchronization Protocols on Reproductive Performance of Barbari Goats

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### ABSTRACT

The present study was designed to evaluate the effect of four estrus synchronization protocols on reproductive performance in barbari goats. Total 40 goats were selected and divided into 4 groups of 10 animals each. The treatment protocols in different groups include, Group I: Two injection of PGF<sub>2</sub>α with 11 days apart, Group II: Two injection of PGF<sub>2</sub>α with 11 days apart along with eCG injection 48 hours before administration of 2<sup>nd</sup> PGF<sub>2</sub>α injection, Group III: Vaginal sponges impregnated with progesterone was inserted into vagina for 11 days and single PGF<sub>2</sub>α injection at the time of sponge removal, Group IV: Vaginal sponge for 11 days with eCG injection on 9<sup>th</sup> day and single PGF<sub>2</sub>α injection at the time of sponge removal. The estrus response rate, induction time & duration of estrus, conception rate, kidding rate, fecundity rate, prolificacy rate, sponge retention and vaginitis rate were estimated in different treatment groups. The results of the present study revealed that the reproductive performance was higher in the group treated with intra vaginal progesterone sponge along with eCG+ PGF<sub>2</sub>α as compared to other treatment groups.

### HIGHLIGHTS

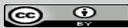
- Induction time of estrus was significantly low in the estrus synchronization protocol having intravaginal sponge plus eCG with PG.
- Double PGF<sub>2</sub> alpha with eCG and Progesterone Sponge with eCG and Single PGF<sub>2</sub> alpha injection are equally effective to get higher conception rate (80%).

**Keywords:** Estrus synchronization, Goats, IVPS, PGF<sub>2</sub>α, eCG, Reproductive performance

Goat was the first animal to be domesticated by man and continue to hold an important niche in developing countries. India has the 2<sup>nd</sup> largest goat population (18%) in the world. Goat plays an important role in Indian economy (8.5% to livestock GDP), source of livelihood and employment to millions of rural households (Kumar *et al.*, 2018). Under semi-arid conditions goats are commonly considered as seasonally polyestrous (photoperiodism) and spontaneously ovulating animals. Estrus synchronization is a valuable reproductive and managerial tool for producers to breed the goats

at a definite time. There are two approaches for estrus synchronization in goats namely, artificial prolongation of diestrus using exogenous progesterone or progestagen or shortening luteal phase by the use of luteolytic agents. Intravaginal progestagen pessaries, progesterone implants or prostaglandins can be used for synchronization of

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estrus. Intravaginal sponges have been the traditional treatment of choice for estrus synchronization in small ruminants, during the breeding and anestrus seasons. They are impregnated with progestagens/progesterone that are effective at lower dose levels than natural progesterone and are inserted in the vagina for 12-14 days. The eCG is most commonly used supporting hormone for estrus synchronization in goats. One limitation of eCG is its long-acting biological activity, causing it to continuously recruit antral follicles, which results in a large number of an ovulated follicles, particularly when given at a dose level to induce mild super ovulation. Prostaglandin ( $\text{PGF}_2\alpha$ ) based estrus synchronization protocols control the estrous cycle by terminating the luteal phase through controlling the life span of CL. There are different protocols for induction of estrus in goats, but the least information on cost effectiveness, farmer-oriented and field applicable estrus synchronization protocols. Improvement of reproductive traits of goat can be achieved by using several reproductive technologies. Since goat breeding in India is non-controlled, an attempt was made to control the breeding by controlling estrous cycles artificially by use of vaginal sponges, eCG and  $\text{PGF}_2\alpha$  injections with different combinations.

## MATERIALS AND METHODS

The study was conducted at the Goat Unit of Livestock Farm Complex (LFC), College of Veterinary Science & Animal Husbandry, DUVASU, Mathura. A total of 40 healthy Barbari does aged about 2 to 4 years with  $\geq 60$  days postpartum, were selected to conduct the experiment. The selected does were divided into 4 groups with 10 goats in each group. Group I (DPG): The does were administered double  $\text{PGF}_2\alpha$  injection with an interval of 11 days apart, Group II (DPG + eCG): The does were administered double  $\text{PGF}_2\alpha$  injection with an interval of 11 days apart and eCG injection on 9<sup>th</sup> day, Group III (IVPS + PG): The does were inserted with intravaginal sponge impregnated with natural progesterone for 11 days. The intra vaginal sponges were removed after 11 days and Injection Cloprostenol Sodium @25  $\mu\text{g}$  was given intramuscularly at the time of removal of intra vaginal sponge and Group IV (IVPS + eCG + PG): Does were inserted with intra vaginal sponge for a period of 11 days and injection eCG (Folligon) @ 200 IU was administered intramuscularly on 9<sup>th</sup> day. Injection Cloprostenol Sodium @25  $\mu\text{g}$  was given intramuscularly

at the time of removal of intra vaginal sponge. Does of all groups were monitored for the symptoms of estrus by using a teaser buck twice daily with an interval of 12 hours for the duration of 30 minutes for four days after second injection of  $\text{PGF}_2\alpha$  in Group I & II and after removal of intravaginal progesterone sponges in Group III & IV. All goats after detection of heat were artificially inseminated with cryopreserved semen (200 million progressive motile spermatozoa/dose) using speculum method as per routine farm practice. The does were subjected to pregnancy diagnosis by using trans-abdominal approach of real time B-mode ultrasonography @ 3 to 5 MHz multifrequency sector array probe. The scanning procedure was started after day 60 of artificial insemination. The efficacy of estrus synchronization treatment protocols was measured in terms of estrus response rate, induction time & duration of estrus, conception rate, kidding, fecundity & prolificacy rate in does. Results were obtained and means were compared using one-way ANOVA. Means were separated using SPSS software and significant differences were declared at 5%.

## RESULTS AND DISCUSSION

### Estrus response rate

Estrus response rate was 100 in all four treatment groups. The similar types of finding of estrus response rate with two injections of  $\text{PGF}_2\alpha$  alone or with eCG was also reported previously. However, in contrast to present study several authors reported lower estrus response as 30% by using PG (Hashemi and Safdarian, 2017), 53% by using double PG and 75% by using PG + eCG in Persian downy does (Wondim *et al.*, 2022). The findings of estrus response rate in IVPS groups was similar as observed in Boer goats (Romano *et al.*, 2016), in Surti does (Sharma *et al.*, 2022) and in local goats (Kanduri *et al.*, 2022b). However, other authors reported lower value of estrus response rate as 82.1 % in Red Sokoto goats (Omontese *et al.*, 2013a), 50% in local non-descript goats (Singh *et al.*, 2018) following use of IVPS having different concentration of natural or synthetic progesterone alone or in combination with  $\text{PGF}_2\alpha$  at sponge removal. Andrade *et al.* (2021), find estrus response rate as 70.0 & 88.5% in Nulliparous & multiparous goats, respectively by using IVPS plus eCG plus PG protocol for estrus synchronization. The

difference in estrus response may be due to breed, environment, difference in estrus synchronization protocol and managemental practices at goat farm (Table 1).

### Induction time of estrus

The mean value of induction time of estrus (hrs) was  $79.2 \pm 3.67$ ,  $55.2 \pm 3.67$ ,  $60.0 \pm 5.37$  and  $31.2 \pm 3.67$  in Group I, II, III and IV, respectively. Induction time of estrus was significantly ( $p < 0.05$ ) low in Group IV as compared to other treatment groups. The induction time of estrus in Group I was longer and in Group II was similar as compared to the finding of Parmar *et al.* (2020) by using NC Synch protocol. Kanduri *et al.* (2022a) reported higher induction time of estrus by using double PG and GnRH as compared to Group II of the present study. However, Wondim *et al.* (2022a) find lower induction time of estrus ( $9.5 \pm 0.58$  hrs) by using double PG at 11 days apart.

The present findings of onset of estrus time in IVPS groups were within the range of the reports of Omontese *et al.* (2013a) and Andrabi *et al.* (2015) by using IVPS plus eCG as synchronization protocol. However, The earlier onset of estrus might be due to PG induced luteolysis. In P4 sponge treatment variation in onset of estrus time mainly influenced by breed, co-treatment, mating method, environmental factors, dose and duration of insertion of progesterone sponge and type of progesterone (Natural/Synthetic) (Table 1).

### Duration of estrus

The mean value of duration of estrus (hrs) was  $29.7 \pm 0.37$ ,  $29.5 \pm 0.40$ ,  $29.4 \pm 0.43$  and  $29.1 \pm 0.43$  in Group I, II, III and IV, respectively. No significant difference was observed in mean value of duration of estrus between all the treatment

groups. The present findings of duration of estrus was in agreement with the results of Esteves *et al.* (2013) and Parmar *et al.* (2020) by using Double  $\text{PGF}_2\alpha$  and NC Synch protocol. Sharma *et al.* (2022) observed duration of estrus between 29.83-31.67 hrs in various estrus synchronization protocols either by using IVPS or IVPS +  $\text{PGF}_2\alpha$  or IVPS + Buck effect. Pujar *et al.* (2016) observed a longer duration of estrus ( $38.00 \pm 5.0$  hrs) in the Ovsynch protocol. Similarly, Kanduri *et al.*, 2022b also observed a longer duration of estrus ( $45.38 \pm 1.89$  hrs) by using two PG and GnRH injections. The difference in duration of estrus between present study and other reports could be due to difference in breed, nutrition and management of the goat herd (Table 1).

### Conception rate

The conception rate (CR) in the study was 50, 80, 70 & 80% in Group I, II, III and IV, respectively. The similar finding of CR either by using double PG injection or NC synch as synchronization protocol has been reported (Parmar *et al.*, 2020). However, in comparison to Group I of present study, several authors reported higher CR by using same protocol (Biradar *et al.*, 2019; Wondim *et al.*, 2022a). The similar finding of CR was reported by using IVPS and PG (Birader *et al.*, 2019), by using IVPS plus PMSG (Sen and Onder, 2015) as synchronization protocol. However, in comparison to present study higher CR has been reported by using IVPS plus PG plus eCG (Dogan *et al.*, 2016) and by using IVPS plus eCG (Hasani *et al.*, 2018) as synchronization protocol. Gore *et al.* (2020) reported lower CR by using CIDR plus PG plus eCG. Eski *et al.* (2021) reported CR of 84% by using short term sponge plus PG and GnRH and CR of 72% by using long term sponge plus PMSG and GnRH. The difference in the

**Table 1:** Effect of different synchronization protocol on the estrus response, Induction time and duration of estrus (hr) in goats (Mean  $\pm$  S.E., n=10)

Treatment Groups	Estrus response rate (%)	Induction time of estrus (hrs)		Duration of estrus (hrs)	
		Mean $\pm$ S.E.	Range	Mean $\pm$ S.E.	Range
I (DPG)	100.00	$79.2 \pm 3.66^c$	72-96	$29.7 \pm 0.36$	28-32
II (DPG + eCG)	100.00	$55.2 \pm 3.66^b$	48-72	$29.5 \pm 0.40$	28-32
III (IVPS + PG)	100.00	$60 \pm 5.36^b$	24-72	$29.4 \pm 0.42$	28-32
IV (IVPS + eCG + PG)	100.00	$31.2 \pm 3.66^a$	24-48	$29.1 \pm 0.43$	28-32

Means with different superscript differ significantly ( $p < 0.05$ ) within a column.

**Table 2:** Reproductive performance of goats in different estrus synchronization protocol groups

Reproductive Parameters	Treatment groups			
	I (DPG)	II (DPG+eCG)	III (IVPS+PG)	IV (IVPS+eCG+PG)
% Conceived at induced estrus	50% (5/10)	80% (8/10)	70% (7/10)	80% (8/10)
% Kidding rate	50% (5/10)	70% (7/10)	80% (8/10)	80% (8/10)
Fecundity rate	50% (5/10)	70% (7/10)	80% (8/10)	80% (8/10)
Prolificacy rate	100% (5/5)	100% (7/7)	114.28% (8/7)	114.28% (8/7)

conception rate between the present and other findings may be due to difference in hormonal protocol, duration of insertion and type of progesterone device, breed and managerial practices of the goat herd (Table 2).

#### Kidding rate

Kidding rate in the study was 50, 70, 50 & 70% in Group I, II, III and IV, respectively. As compared to present study higher kidding rate was reported by several workers by using double PG as synchronization protocol (Parmar *et al.*, 2020; Wondim *et al.*, 2022a). However, lower value of kidding rate reported by Hashemi and Safdarian (2017) by using single PG and single PG with eCG synchronization protocols. The present finding of kidding rate in IVPS groups are in agreement with the finding of Gore *et al.* (2020) by using CIDR plus PG with eCG and by using IVPS plus eCG (Hashemi and Safdarian, 2017) in goats. However, higher kidding rate was reported by Wondim *et al.* (2022b) by using IVPS plus eCG with PG as synchronization protocol. The various authors reported higher kidding rate by using IVPS plus eCG protocol for estrus synchronization (Senand Onder, 2015; Kumar *et al.*, 2018). In comparison to the IVPS plus PG group of the present study, higher kidding rate was reported by various authors by using IVPS alone as protocol (Hashemi and Safdarian, 2017; Kumar *et al.*, 2018). The difference in kidding rate may be due to difference in hormonal protocol and type of progesterone used in intravaginal device (Table 2).

#### Fecundity rate

The fecundity rate was 50, 70, 80 and 80% in Group I, II, III and IV, respectively. Hashemi and Safdarian

(2017) reported fecundity rate of 100 and 60% by using single PG and single PG plus eCG, respectively. Similar fecundity rate was reported by using IVPS alone and higher fecundity rate was reported by using IVPS plus eCG protocol (Hashemi and Safdarian, 2017) (Table 2).

#### Prolificacy rate

Prolificacy rate was 100 & 114.28% in PG and IVPS groups, respectively. Hashemi and Safdarian (2017) reported prolificacy rate of 120 and 112.5 by using single PG and single PG plus eCG, respectively. The findings are in agreement with the finding of Hashemi and Safdarian (2017) (Table 2).

#### CONCLUSION

All four estrus synchronization protocols resulted in 100% estrus response. The induction time (hrs) of estrus was significantly ( $p < 0.05$ ) low in the estrus synchronization protocol having intravaginal sponge plus eCG with PG (Group IV) as compared to other treatment groups. No significant difference was observed in duration of estrus (hrs) between different synchronization protocols. Highest conception rate (80%) was observed in Group IV as compared to other treatment groups. Double PGF<sub>2</sub> alpha with eCG and progesterone sponge with eCG and single PGF<sub>2</sub> alpha injection are equally effective to get higher conception rate (80%). Double PGF<sub>2</sub> alpha alone has lower conception rate as compared to other treatment groups.

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