RESEARCH ARTICLE

Efficacy of Various Estrus Synchronization Protocols in Improving Conception Rate in Surti Goats

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Abstract

The objective of the study was to compare the efficacy of three different estrus synchronization protocols for estrus induction/ synchronization and conception rate in Surti does. Forty adult non-pregnant Surti goats were selected and equally divided based on serum progesterone levels into four groups (n=10 each*), viz.,* Group-1: Intravaginal sponge protocol with natural service by intact buck after sponge removal, Group-II: Double $PGF_2\alpha$ injection protocol (11 days apart) with natural service within 48 to 144 h after 2nd PG injection, and Group-III: Ovsynch protocol with natural service after 2nd GnRH injection, and Group-IV: was kept as untreated control. Goats having progesterone level ≤0.8 ng/mL and ≥1.4 ng/mL were kept in Group-I and III, and in Group-II, respectively. The estrus response was found 100% in the goats kept under each treatment group and 30% in control during study period of two months. Estrus induction intervals from last $PGF_2\alpha$ injection were statistically similar in all treatment protocols. Significantly ($p<0.05$) shorter estrus duration was observed in ovsynch as compared to intravaginal sponge and double $PGF_2\alpha$ injection protocols. Conception rates in Group I, II and III at induced estrus were 60, 80 and 40, and overall of 3 cycles 100, 100 and 80 %, respectively. In control Group-IV, out of 3 goats exhibited estrus, 1 conceived at first estrus and 1 in 2nd cycle. Thus, double PG treatment protocol (Gr-II) appeared the best, followed by vaginal sponge (Gr-I) in terms of conception rate at induced estrus (80 vs. 60%), and overall of 3 cycles (100 vs. 100%) over Ovsynch protocol (Gr-III), and untreated control goats.

Key words: Conception rate, Double PG injection, Estrus synchonization, Ovsynch, Surti goats, Vaginal sponge.

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Introduction

Livestock rearing is one of the most important economic activities in the rural areas of the country, contributing significantly to the national economy. India possesses an enormous goat population numbering 148.88 million (Livestock Census, 2019), which is the second highest after cattle population and constitutes an important role in rural livestock as it provides employment on a large scale to the down trodden people, and hence, it is essential to improve the reproductive efficiency in these small ruminants using different scientific techniques. Goats are seasonally polyoestrous animals (Saribay *et al.,* 2012). However, most of the Indian goat breeds show estrus throughout the year (Mazumdar and Mazumdar, 1983). The Surti goat is one of the best dairy goats. The total population of this breed is very small (0.30% of total goat population, GOI, 2013), when compared to other goat breeds and it is one of the endangered breeds of goats of Indian origin (Mandal *et al.,* 2014).

Profitability of goat rearing depends on exploitation of fertility potential which can be achieved with assisted reproductive technology (ART). The value of estrus synchronization is vital in goats as the duration of both estrous cycle and estrus is variable (Rahman *et al.,* 2008) and they exhibit silent estrus (Greyling and Van der Nest, 2000). Synchronization of estrus with timed hormonal treatment is an extensively used ART in small ruminants (Biradar *et al.,* 2019). Estrus synchronization is manipulation of either luteal or follicular phase of the estrous cycle for making the animals to attain estrus at the same day using exogenous hormones (Wildeus, 2000). Hence, this study was carried out to compare the efficacy of various estrus synchronization protocols on conception rates in Surti goats.

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Materials and Methods

The Surti does between 2 and 3 years of age with a body weight of 25 to 30 kg were selected for the experiment. Before initiating trial, adult Surti does were kept separate from the buck for 30 days and does were scanned by transabdominal ultrasonography (USG) to determine the pregnancy, if any. The non-pregnant does were kept isolated further for one month and again transabdominal USG was done to rule out missed early pregnancy, if any, during previous scanning.

At the time of initiation of experiment, based on the serum progesterone (P_4) value, a total of forty non-pregnant does were equally divided into three hormonal protocols and one control group (n=10/group). In group-I and III, does having serum P_4 concentration ≤ 0.8 ng/ml were synchronized using intravaginal sponge and ovsynch protocol, respectively. In group-II, does having serum P_4 concentration ≥1.4 ng/ml were synchronized using double $PGF_2\alpha$ injection protocol. In group-I, intravaginal sponge was inserted for 11 days. All does were injected with inj. cloprostenol sodium @ 125 µg/doe one day before sponge removal and with inj. GnRH @ 8 µg/doe intramuscularly at sponge removal. In group-II, does were injected with inj. cloprostenol sodium @ 125 µg/doe twice at 11 days apart. In group-III, does were injected with inj. GnRH (Buserelin acetate) @ 8 µg/doe on day 0, followed by inj. cloprostenol sodium @ 125 µg/doe on day 7 and inj. GnRH @ 8 µg/doe on day 9, intramuscularly. Buck was introduced to goats after sponge removal; after 48 h of 2nd $PGF_2\alpha$ injection and after 2nd GnRH injection for breeding in group-I, II and III, respectively. The does under each treatment group returning to estrus, after first breeding were again kept with a fertile Surti buck for 5 days for two more subsequent estruses. In group IV (Control) ten does having either side of progesterone concentration (≤ 0.8 and ≥ 1.4 ng/ml) were kept with a fertile Surti buck for sixty days without any hormonal therapy.

The data so generated of conception rates at induced estrus and overall of 3 cycles among treatment groups were analysed using Chi-square test.

Results and Discussion

Estrus Induction Response and Induction Interval

In current experiment, cent per cent estrus induction response was recorded in all three estrus synchronization protocols (Table 1), which corroborated well with the reports of Cinar *et al.* (2017), Chaudhary *et al.* (2018) and Farooqi *et al.* (2021) for groups III, II and I, respectively.

Mean interval for induction of estrus from $PGF_2\alpha$ injection in intravaginal sponge, double $PGF_2\alpha$ injection and ovsynch protocols were 52.80±0.92, 50.70±1.64 and 51.90±1.27 h, respectively, which were statistically similar (Table 1). Mean estrus induction interval after $PGF_2\alpha$ injection recorded by Dogan *et al.* (2016), Senthilkumar *et al.* (2016), Eski *et al.* (2021) and Pangestuningrum *et al.* (2021) in different breeds of goats was longer than current finding of group-I. Hafid *et al.* (2021) reported estrus induction interval of 25.13 h from 2nd $PGF_2\alpha$ injection, which is lower than present finding of 50.70±1.64 h in group-II. Senthilkumar *et al.* (2016) and Farooqi *et al.* (2021) also reported shorter estrus induction interval than current finding in does of group-II.

Duration of Estrus

Mean duration of estrus in intravaginal sponge, double $PGF_2\alpha$ and ovsynch protocol was 33.90±1.79, 32.10±1.73 and 24.30±0.94 h, respectively (Table 1). A significant ($p<0.05$) difference was found in ovsynch protocol with lesser duration of estrus in comparison to intravaginal sponge and double $PGF_2\alpha$ protocols. The duration of estrus recorded in group I & II was longer than 23.5±1.1 h reported by Dogan *et al.* (2016) and 27.50±1.23 h by Chaudhary *et al.* (2018), respectively; however, Kanduri *et al.* (2022) recorded higher duration of induced estrus (38.25±1.76 h) with ovsynch protocol than present finding in group-III.

Conception Rate

Overall, 100 (10/10) per cent conception rate was found in both intravaginal sponge and double $PGF_2\alpha$ injection protocols. However, under ovsynch protocol significantly lower [80% (8/10)] conception rate was observed as compared to other two treatment protocols. Conception rates at induced estrus in Surti goats covered under intravaginal sponge, double $PGF_2\alpha$ injection and ovsynch protocols were found to be 60.00 (6/10), 80.00 (8/10) and 40.00 (4/10) %, respectively. All the Surti goats treated under intravaginal sponge and double $PGF_2\alpha$ injection protocols conceived by 2nd cycle post-treatment. However, under ovsynch protocol only 33.33% (2/6) goats conceived at 2nd cycle post-treatment and among the remaining non-conceived goats, 50.00 % (2/4) were conceived in 3rd cycle post-treatment, giving overall 3 cycles conception rate of 80.00 % (Table 2). Conception rates at induced estrus differed significantly among treatment protocols, being lowest in ovsynch protocol followed by

Table 1: Estrus induction response, $PGF_2\alpha$ inj. to estrus induction interval and duration of estrus in Surti does under different estrus synchronization protocols

Synchronization protocols	No. of animals	Estrus induction response (%)	$PGF_2\alpha$ inj. to estrus induction interval (h)	Duration of estrus (h)
Intravaginal sponge	10	10/10 (100%)	52.80±0.92	33.90^{b}±1.79
Double PGF2α injection (11 D apart)	10	10/10 (100%)	50.70±1.64	32.10^{b}±1.73
Ovsynch	10	10/10 (100%)	51.90±1.27	24.30^{a}±0.94

Table 2: Conception rates in goats under various estrus synchronization protocols at induced / 1st estrus, 2nd cycle, 3rd cycle and overall of 3 cycles

Synchronization protocols	No. of animals	Conception Rate (%)			
		Induced/First estrus	Second cycle	Third cycle	Overall of 3 cycle
Intravaginal sponge	10	60.00% (6/10)	100% (4/4)	-	100% (10/10)
Double PGF2α injection	10	80.00% (8/10)	100% (2/2)	-	100% (10/10)
Ovsynch	10	40.00% (4/10)	33.33% (2/6)	50.00% (2/4)	80.00% (8/10)
χ2 Test		χ2 = 13.33 **			χ2= 51.43 **
Control	10	33.33% (1/3)	50.00% (1/2)	0.00% (0/1)	66.66% (2/3)

** Highly significant (P<0.01) between treatment groups

intravaginal sponge and double $PGF_2\alpha$ injection protocol. In addition to this, only 3 goats came in estrus in control group IV during study period of two months. Among them, one goat conceived in 1st cycle and one more in 2nd cycle, while the third goat remained un-conceived. Thus, 33.33 (1/3), 50.00 (1/2) and 66.66 (2/3) % conception rates were achieved in 1st, 2nd and overall of 3 cycle, respectively, in control group IV.

Cent per cent overall conception rate observed in group-I was almost double than the 51.70 % reported by Amle *et al.* (2018). Anya *et al.* (2017) and Chaudhary *et al.* (2018) observed 88.24 and 83.33 % overall conception rate in does treated with double $PGF_2\alpha$ injection protocol, which are in harmony with the present finding of group-II. Comparatively lower overall conception rates of 56.00 and 42.80 % than the current finding of group-III were reported by Al-Hassan and Al-Samawi (2017) and Farooqi *et al.* (2021), respectively. The variation in results recorded in different studies could be due to differences in breed, age, season, nutritional and physiological status of animals, hormonal products used, estrus detection and breeding strategies adopted etc.

Conclusions

The estimation of serum progesterone levels by radioimmunoassay helped to confirm the current ovarian status of the does before undertaking various hormonal protocols for synchronization of ovulation and to observe the response to treatment in terms of estrus induction and pregnancy rate. Cent per cent estrus response with all three treated (intravaginal sponge, double $PGF_2\alpha$ and ovsynch) protocols indicate that 125 µg cloprostenol was sufficient to produce luteolysis in Surti goats. The application of all three protocols were found to be good tools for induction and synchronization of estrus (100%) and ovulation as well as cyclicity and enhancement of pregnancy rate in Surti goats. Further, double $PGF_2\alpha$ injection protocol appeared better followed by intravaginal sponge for conception rate at induced estrus.

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References

Al-Hassan, M.J., & Al-Samawi, K.A. (2017). Seasonal variations in serum pregnancy associated glycoproteins during early pregnancy in Aardi goats in central Saudi Arabia. *Asian Pacific Journal of Reproduction, 6*(5), 226-230.

Amle, M.B., Birade, H.S., & Gulawane, S.U. (2018). Reproductive parameters following estrus synchronization of Sangamneri and Osmanabadi goats. *Indian Journal of Animal Reproduction, 39*(1), 46-48.

Anya, K.O., Ekere, S.O., & Ogwu, D.O. (2017). Early pregnancy diagnosis using trans-abdominal ultrasonography in West African Dwarf goats. *Nigerian Veterinary Journal, 38*(4), 311-318.

Biradar, V., Paul, M.K., Simon, S., Kurien, M.O., Lali, F.A., & Gleeja, V.L. (2019). Efficiency of three different protocols of oestrus synchronization in malabari goats. *The Pharma Innovation Journal*, *8*(8), 143-146.

Chaudhary, M.M., Khasatiya, C.T., Chaudhari, N.F., Tyagi, K.K., Kharadi, V.B., & Atara, V.B. (2018). Synchronization of estrus by buck effect and $PGF_2\alpha$ treatment in Surti does. *The Indian Journal of Veterinary Sciences and Biotechnology, 13*(3), 55-59.

Cinar, M., Ceyhan, A., Yilmaz, O., & Erden, H. (2017). Effect of estrus synchronization protocols including $PGF_2\alpha$ and GnRH on fertility parameters in Hair goats during breeding season. *The Journal of Animal and Plant Sciences, 27*(4), 1083-1087.

Dogan, I., Nur, Z., & Dogan, S. (2016). Different progestagen treatment for estrous synchronization during the natural breeding season in non-lactating Anatolian black goats. *Animal Reproduction, 13*(4), 806-810.

Eski, F., Kurt, S., & Demir, P.A. (2021). Effect of different estrus synchronization protocols on estrus and pregnancy rates, oxidative stress and some biochemical parameters in Hair goats. *Small Ruminant Research, 198,* 106348.

Farooqi, Z.R., Ahmad, E., Akhtar, M.S., Ahmad, T., Khan, M.I.R., Naseer, Z., Sattar, A., & Serin, I. (2021). Efficacy of progesterone or GnRH based estrous synchronization protocols in Beetal goats during low breeding season. *Journal of Animal and Plant Sciences, 31*(6), 1867-1872.

Government of India. (2013). Estimated Livestock Population Breed Wise. Retrieved from, https://dahd.nic.in/sites/default/filess/Breeding%20Survey%20Book%20-%20Corrected.pdf

Greyling, J.P.C., & Van der Nest, M. (2000). Synchronization of oestrus in goats: Dose effect of progestagen. *Small Ruminant Research*, *36*, 201-207.

Hafid, A.A., Anggraeni, A., Pamungkas, F.A., Sianturi, R.G., Kusumaningrum, D.A., Ishak, A. B.L., & Mukhlisah, A.N. (2021). Estrous responses synchronized by a combination of $PGF_2\alpha$ and GnRH hormones in Sapera goat. *IOP Conference Series: Earth and Environmental Science, 788*, 012130.

Kanduri, A.K.R., Reddy, K.C.S., Ramana, V.K., Venkateshwarlu, M., Swathi, B., & Kannegundla, U. (2022). Effect of different estrus synchronization protocols on reproductive performance in Mahabubnagar local goats. *The Pharma Innovation Journal, SP-11*(3), 1448-1452.

Livestock Census (2019). 20th Livestock Census 2019 - All India Report. Ministry of Fisheries, Animal Husbandry & Dairying, Department of Animal Husbandry & Dairying, Animal Husbandry Statistics Division, New Delhi. Retrieved from, http://dadf.gov.in/sites/default/ filess/20th%20Livestock%20census-2019%20All%20India%20Report.pdf

Mandal. A., Karunakaran, M., Rout, P. K., & Roy, R. (2014). Conservation of threatened goat breeds in India. *Animal Genetic Resources, 55,* 47-55.

Mazumdar N., & Mazumdar, K. (1983). Breed characteristics of some Indian Pashmina goats. *Indian Journal of Animal Science, 53,* 779-782.

Rahman, A.N.M.A., Abdullah, R.B., & Wan-Khadidjah, W.E. (2008). Synchronization and superovulation in goats: A review. *Journal of Biological Sciences*, *8,* 1129-1137.

Pangestuningrum, J., Madyawati, S.P., Eliyani, H., Damayanti, R., & Rochmi, S.E. (2021). Etawa goat estrus quality with estrus synchronization. *Journal of Applied Veterinary Science and Technology, 2,* 15-21.

Saribay M.K., Karaca, F., Dogruer, G., & Ates, C.T. (2012). Effects of long and short-term progestagen treatments plus GnRH followed by TAI on fertility parameters in lactating Hair goats during the transition period. *Kafkas Universitesi Veteriner Fakultesi Dergisi, 18,* 507-511.

Senthilkumar, K., Selvaraju, M., Napolean, E.R., Doraisamy, K.A., & Mohan, B. (2016). Pattern of oestrus and fertility rate following synchronization of ovulation in Tellicherry goats. *International Journal of Science, Environment and Technology, 5*(5), 3289-3296.

Wildeus, S. (2000). Current concepts in synchronization of oestrus: sheep and goats. *Journal of Animal Science, 77,* 1-14.