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## Effect of chitosan combined with Ovsynch protocol on fertility and fecundity rate in Salem black goats

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**Abstract**

A total of 30 healthy, parous Salem Black does, 60 days post-partum were selected for the study after gynaecological examination. The does were divided into two groups: Group I (Control-Ovsynch) and Group II (Treatment-Chitosan-synch). In Group I, all does were treated with the Ovsynch protocol and in Group II, a modified Ovsynch protocol was followed, incorporating 1 ml of chitosan conjugated with GnRH (4µg) on day 0, 250 micrograms of PGF<sub>2α</sub> seven days later (day 7) and another 4 µg of chitosan-conjugated GnRH (Second GnRH) 48 hours after the PGF<sub>2α</sub> injection (day 9). All the does artificial insemination (AI) was carried out 16-18 hours after the second GnRH injection (Day 10). Higher conception rate (80 Per cent) achieved in Group II does than Group I does (53 Per cent). The fecundity rate was also higher in Group II (1.50) when compared with Group I (1.37). Hence concluded that Chitosan synch yielded better conception rate and fecundity rate than traditional Ovsynch protocol.

**Keywords:** Ovsynch, chitosan-synch, GnRH, PGF<sub>2α</sub>, fertility, fecundity

**Introduction**

Goats are a vital livestock species in India, playing a crucial role in the livelihoods of small and marginal farmers, landless laborers and the rural economy at large (Senthilkumar *et al.*, 2022) [17]. India boasts rich biodiversity in indigenous goat breeds, one of which is the Salem Black, originating from Salem district of Tamil Nadu and well suited to the region's environmental challenges (Aleena *et al.*, 2018) [1]. Assisted reproductive technologies (ARTs) have proven instrumental in improving the reproductive efficiency of small ruminants. The conventional "Ovsynch" or "GPG" protocol, which involves a sequential treatment of GnRH-PGF<sub>2α</sub>-GnRH (Nur *et al.*, 2013 and Panjaitan *et al.*, 2019) [6,7].

Various protocols for synchronization of estrus and ovulations had been practiced by Various scientists using medroxyprogesterone acetate (Selvaraju *et al.*, 1997) [10,11] and fluorogesterone acetate (Selvaraju and Kathiresan, 1997) [10,11] and CIDR and norgestomet (Selvaraju *et al.*, 2004) [12] in goats. Similar protocols were utilized using PGF<sub>2α</sub> and Norgestomet (Selvaraju *et al.*, 1997) [10,11], norgestomet alone (Selvaraju *et al.*, 2009) [13], PGF<sub>2α</sub> alone (Selvaraju *et al.*, 2010a) [14], hCG and norgestomet (Selvaraju *et al.*, 2010b) [15] and PGF<sub>2α</sub> plus hCG (Selvaraju *et al.*, 2010c) [16] for synchronization of estrus and ovulation. Exhibits shortcomings, including scattered ovulation times, a short luteal phase, and reduced luteal function, which require modifications and improvements (Hashem *et al.*, 2015) and (Ali *et al.*, 2009) [4,2]. The emerging technique of nano-drug delivery has shown improved hormone and drug delivery, for its unique properties such as smaller size, high size-to-weight ratio, surface charge variations, and shapes different from the original drugs (Hashem and Sallam, 2020) [5]. In this view the present study aims to evaluate the conception and fecundity of Salem Black goats synchronized for estrus using both the conventional Ovsynch protocol and chitosan coated GnRH Ovsynch protocol.

**Materials and Methods**

A total of 30 healthy, parous Salem Black does, 60 days post-partum, underwent thorough gynaecological examinations and were selected for the study. The does were divided into two groups: Group I (Control-Ovsynch) and Group II (Treatment-Chitosan-synch). All selected does were orally dewormed at the time of selection and supplemented with TANUVAS mineral mixture for 30 days, starting from the day of selection.

**Group I (Ovsynch Protocol)**

In Group I, all does were treated with the Ovsynch protocol as described by Pursley *et al.*

(1995) [8] in cows, with a reduction in dose. The protocol involved an intramuscular injection of 10 µg of GnRH on day 0, 250 micrograms of PGF<sub>2</sub>α seven days later (day 7), and another 10 µg of GnRH (second GnRH) 48 hours after the PGF<sub>2</sub>α injection (day 9). Timed breeding by artificial insemination (AI) was performed 16-18 hours after the second GnRH injection (Day 10).

### Group II (Chitosan-synch)

In Group II, a modified Ovsynch protocol was followed, incorporating 1 ml of chitosan (9012-76-4, Sigma-Aldrich) conjugated with GnRH (4µg) on day 0, 250 micrograms of PGF<sub>2</sub>α seven days later (day 7) and another 4 µg of chitosan-conjugated GnRH (Second GnRH) 48 hours after the PGF<sub>2</sub>α injection (day 9). Timed breeding by artificial insemination (AI) was carried out 16-18 hours after the second GnRH injection (Day 10).

Chitosan conjugated GnRH was prepared using gelation method as described by Boonthum *et al.* (2018) [3].

### Results and Discussion

In the present study, 80 per cent conception rates were achieved in Group II (Chitosan-synch) which was significantly higher than Group I (Control-Ovsynch) with a conception rate of 53 Per cent (Table 1). Chitosan, with its sustained and controlled release of GnRH hormone, enhances

bioavailability, prolongs the half-life, and provides resistance to enzymatic degradation, ultimately improving the efficacy of GnRH treatment. This might have resulted significantly higher conception rates in Group II (80 Per cent) compared to Group I (53 Per cent). Chitosan's ability to improve hormone stability and protect it from rapid degradation during transportation contributed to this effect (Rather *et al.*, 2013) [9].

The fecundity rate was higher in Group II (1.50) when compared with Group I (1.37) and is presented in table 1. A previous study in goats indicated that the use of chitosan sodium tripolyphosphate (TPP) reduced the dosage of GnRH by 75 Per cent without any deleterious effects on fertility and prolificacy, indicating that chitosan increases the hormone's bioavailability (Hashem and Sallam, 2020) [5]. This suggests that chitosan-conjugated GnRH facilitated better follicular growth and development, ultimately increasing fecundity.

Similarly, our study also achieved a higher conception rate with a reduced dose of 4µg of chitosan-coated GnRH when compared to the Ovsynch protocol and the result of the present study is in accordance with Hashem and Sallam (2020) [5]. In this context, the study underscores the potential of chitosan as a hormone carrier for improving hormone stability and bioavailability, thus enhancing reproductive outcomes.

**Table 1:** Conception and Fecundity Rates Following Ovsynch and Chitosan-Synch Treated Groups

S. No	Treatment groups	No of does treated	Conception Rate (AI) (%)	Fecundity Rate		
				No of does kid	No of kids born	No of kids per doe
1	Group-I	15	53 (8/15)	8	11	1.37
2	Group-II	15	80 (12/15)	12	18	1.50

### Conclusion

In conclusion, highlights the effectiveness of chitosan conjugated GnRH as a valuable tool for enhancing the conception rates and fecundity, offering a practical solution to enhance reproductive outcomes in goat.

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