



ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; SP-11(3): 1448-1452
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www.thepharmajournal.com
Received: 09-12-2021
Accepted: 02-02-2022

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Effect of different estrus synchronization protocols on reproductive performance in Mahabubnagar local goats

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Abstract

A total of 60 does aged between 2-5 years located at Livestock Research Station, Mahabubnagar were selected and divided into 3 equal groups. First group were not treated with any protocol and considered as control group. Second group (GPG/Ovsynch) were treated with GnRH on day 0, PGF2 α on day 7 and GnRH on day 9 intramuscularly. Third group (PPG/double PGF2 α with GnRH) were treated with PGF2 α on day 0, 7 and GnRH on day 9 intramuscularly. Estrus response was observed from 9th to 14th day after GnRH treatment. The average time taken for onset of estrus was 124 \pm 4.59, 52.37 \pm 3.59 and 65.25 \pm 3.58 hours in control, GPG and PPG group respectively. The duration of estrus in control, GPG and PPG groups were 28.30 \pm 2.22, 38.25 \pm 1.76 and 45.38 \pm 1.75 hours respectively. The average estrus response rate was 50%, 80% and 80% in control, GPG and PPG group respectively. Conception rates were 50%, 80% and 80% respectively in control, GPG and PPG group. Kidding rate was 80% in control group and 100% in GPG and PPG groups. The average litter size in control, GPG and PPG were 1.25, 1.31 and 1.37 while, twinning percentage was 25%, 31.2% and 37.5% respectively. The present study revealed that the GPG and PPG protocols were equally effective in inducing estrus response, early onset of estrus and higher conception rates when compared to control group.

Keywords: Mahabubnagar local goats, Estrus synchronization, Ovsynch, GnRH, PGF2 α

Introduction

India stands second in the world's goat population with 148.88 million which constitutes 27.79% of the total livestock population (20th livestock census, 2019). In India Telangana state stands 12th position with 4.94 million population. Erstwhile Mahabubnagar district of Telangana is holding 0.61 million local goats which are commonly called Mahabubnagar goats. Goat rearing provides income and livelihood to the poor and most of the small and marginal farmers showing interest in rearing goat due to smaller investments, short reproduction cycles, faster growth rates and greater environmental adaptability. Production and reproduction performance in local goats is low/marginal because of low genetic value, prominent seasonal breeding tendency and uncontrolled reproduction. Goat reproductive cycles are seasonal and that can be controlled using different methods of estrus synchronization protocols, which were simple, cost-effective, and significant in goat breeding to attain more kid crop (Zhao *et al.*, 2010) [17].

Assisted reproductive technologies (ARTs) are powerful tools to enhance reproductive efficiency of small ruminants by increasing estrus response rate, estrus synchronization, pregnancy rate and prolificacy in shorter duration even in non-breeding seasons. The estrus synchronization protocols established in small ruminants were yielding maximum estrus response rate, best kidding percentage to manage the kid crop to attain more profits to the farmers. The principle behind the estrus synchronization is controlling luteal phase of the estrus cycle either by providing exogenous progesterone or by pre mature luteolysis by means of luteolytic agents. Single or combined use of hormones such as progestagens, estrogens, melatonin, PGF2 α , PMSG, HCG and GnRH can be used for synchronization of estrus.

Although several studies have attempted to improve the breeding efficiency in goats, only few studies have been conducted in Mahabubnagar local goats. Hence, the present study was objectivised to test the different established estrus synchronization protocols in Mahabubnagar local goats and the results were analysed to identify the significant effect on estrus response, duration of estrus and reproductive performance.

Materials and Methods

Selection of experimental animals

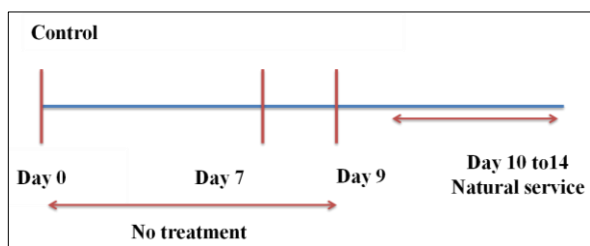
A total of 60 does and 6 bucks of Mahbubnagar local goats aged between 2 to 5 years located at Livestock Research Station, Mahabubnagar, PV Narasimha Rao Telangana Veterinary University (PVNRTVU), were selected for the present study. The does which were completed Sixty days of post-partum period with 2 to 4 of body condition score (BCS), normal kidding history without any reproductive problems were selected for the experiment. The Livestock research station is located at Mahabubnagar with 16.737509 of longitude, 78.008125 latitude and 504 mts. above the mean sea level. The selected does were divided into 3 groups consisting of 20 in each group.

The does and bucks were properly tagged with ear tags, dewormed and vaccinated as per schedule to acquire sound data to eliminate the manual error. The animals were fed with a daily ration of 200 grams of concentrate mixture per animal and free access to green grass, water and mineral licks were made available. They were provided night shelter in the shed.

Treatment groups

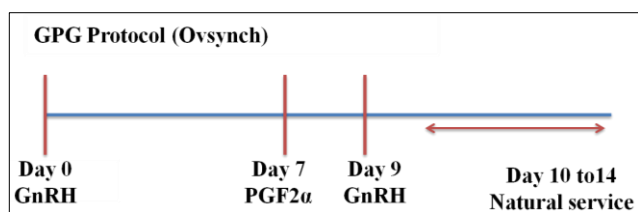
Group I (control group without any treatment)

This group of does were not treated with any treatment protocol and checked for the estrus response from 9th day.



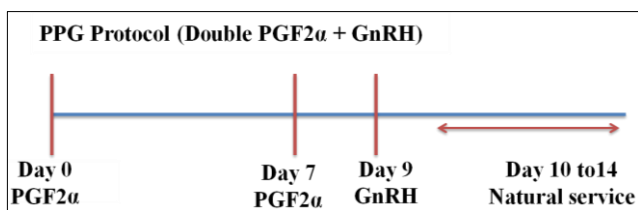
Group II – GPG Protocol (GnRH + PGF2α+GnRH)

This group of does were treated with Inj. GnRH (10µg) on day 0, Inj. PGF2α (125 µg) on day 7 and Inj. GnRH (10 µg) on day 9 intramuscularly and checked for the estrus response from 9th day.



Group III (PGF2α + PGF2α + GnRH):

This group of does were treated with Inj. PGF2α (125µg) on day 0, Inj. PGF2α (125µg) on day 7 and Inj. GnRH (10µg) on day 9 intramuscularly and checked for the estrus response from 9th day.



Bucks were included into all the groups on day 10-14 and natural service was allowed during standing estrus.

Reproduction traits estimated

The onset of Estrus, Estrus response rate, duration of Estrus, conception rate, kidding rate, litter size and twinning percentage were recorded in the study. The different reproductive traits estimated in the present study were enlisted below

Time taken for onset of estrus

It is the duration/time taken from the end of treatment to first appearance of behavioural signs of estrus. It is expressed in terms of hours.

Duration of estrus

Does of all groups were monitored for the symptoms of estrus by using a ram. The time of first acceptance of mating to the last acceptance of mating by the buck was considered as duration of estrus. It is expressed in terms of hours.

Estrus response rate

Estrus response rate was calculated by the number of does in estrus divided by the number of does treated and multiplied by hundred.

Estrus response rate (%) = (No. of does showing signs of estrus/ no. of does treated) X 100

Conception rate

It is calculated by the number of does conceived divided by total number of does treated multiplied by 100. It is expressed in percentage. Pregnancy diagnosis was done by ultrasonography (ALOKA Japan, Prosound 2) by using transrectal linear probe with 7.5 MHz transducer between 40-45 days after mating.

Conception rate (%) = (Number of does conceived/Total number of does treated) X 100

Kidding rate

It is calculated by the number of does having birth divided by number of pregnant does multiplied by 100. It is expressed in percentage.

Kidding rate (%) = (Number of does having birth/ Number of pregnant does) X 100

Twinning rate

It is calculated by the number of does with twin kids divided by Number of does having birth multiplied by 100. It is expressed in percentage.

Twinning rate (%) = (Number of does with twin kids/ Number of does having birth) X 100

Litter size

It is calculated by the Number of kids born divided by Number of does having birth
Litter size = (Number of kids born/Number of does having birth)

Results and Discussion

Effect of GPG & PPG protocols on Onset of estrus

Onset of estrus and duration of estrus are significantly differed in the treated groups (GPG & PPG) over the control is (Table 1 & Figure 1) an indication that the synchronization

protocols will results early onset of estrus response and higher duration of estrus in the population. In the present study, the time taken for onset of estrus was 124 ± 4.59 hrs in the control group. Whereas, higher time for onset of estrus observed by Osman and Elzagaffi 2016 ^[10] (181 ± 45.51 hours) in desert goats.

The present study shown time taken for onset of estrus in GPG group from second GnRH injection (9th day) was 52.37 ± 3.59 hours Whereas, lesser time for onset of estrus was reported in Tellicherry goats as 36.55 ± 0.60 hours (Senthil Kumar *et al.*, 2016) ^[15] and malabari cross bred goats as 49.92 ± 1.94 hours (Panicker *et al.*, 2015) ^[16].

The present findings shown the time taken for onset of estrus from GnRH injection in PPG protocol from 9th day was 65.25 ± 3.58 hours whereas, higher time for onset of estrus was recorded by Osman and Elzagaffi 2016 ^[10] in desert goats as 69.60 ± 0.65 hrs, lesser time for onset of estrus was reported by Bitaraf *et al.* (2007) ^[2] in Nadooshani goats as 26 hrs, Riaz *et al.* (2012) ^[6] in Beetal and dwarf goats as 36.0 ± 1.2 hrs, Omontese *et al.* (2013) ^[9] in Red sokoto does as 32.1 ± 2.3 hrs, and Parmar *et al.* (2020) ^[12] in Surti goats as 52.33 ± 1.35 hours (Table 1).

Effect of GPG & PPG protocols on Duration of estrus

The duration of estrus observed in ovsynch protocol was 38.25 ± 1.76 hours (Table 1). This was in agreement with the findings of Pujar *et al.* (2016) ^[13] in Osmanabadi goats. Whereas, higher duration (44.7 ± 4.9) reported by Riaz *et al.* (2012) ^[6] in Beetal and Dwarf goats. Lesser duration of estrus was observed as 32.60 ± 0.73 hours in Telicherry goats (Senthil Kumar *et al.* 2016) ^[15] and 35.05 ± 4.79 hrs in Malabari crossbred goats (Panicker *et al.* 2015) ^[16].

The duration of estrus observed in present study using PPG protocol was 45.38 ± 1.75 hrs (Table 1), which was in agreement with the findings of Omontese *et al.* (2013) ^[9] in Red sokoto does (41.1 ± 0.9 hours) and Riaz *et al.* (2012) ^[6] in Beetal and dwarf goats (47.1 ± 2.9 hours). Whereas, lower duration of estrus was reported by Bitaraf *et al.* (2007) ^[2] in Nadooshani goats as 22.0 ± 0.3 hours, Osman and Elzagaffi (2016) ^[10] in Desert goats as 20.80 ± 0.13 hrs and Parmar *et al.* (2020) ^[12] in Surti goats as 28.72 ± 0.54 hours.

The observed duration of estrus in control group is 28.30 ± 2.22 hours (Table 1 & Figure 1). Higher duration was reported by Kavitha *et al.* (2018) ^[8] in non-descript does as 40.93 ± 1.49 hours. Whereas lower duration of 22.20 ± 0.53 hrs observed by Osman and Elzagaffi (2016) ^[10] in Desert goats.

Table 1: Effect of different estrus synchronization protocols on onset and duration of estrus (hours)

| Protocol | Onset of estrus (hours) | Duration of estrus (hours) |
|----------------------|----------------------------|----------------------------|
| Control (n=20) | 124.00 ± 4.59^a (n=10) | 28.30 ± 2.22^c (n=10) |
| GPG (n=20) (Ovsynch) | 52.37 ± 3.59^b (n=16) | 38.25 ± 1.76^b (n=16) |
| PPG (n=20) | 65.25 ± 3.58^b (n=16) | 45.38 ± 1.75^a (n=16) |
| F-value | 0.001 ^s | 0.001 ^s |

S – Significant, Means followed by similar superscript(s) do not differ significantly

Effect of GPG & PPG protocols on Estrus response rate

Estrus response rate is significantly higher in the treated groups over the control. It is an indication that the synchronization protocols resulted higher estrus response rate than the control (Table 2).

Estrus response rate in the present study using ovsynch (GPG) protocol is 80% (16/20). However, lower estrus response of 71% was reported by Riaz *et al.* (2012) ^[6] in beetal and dwarf does and 75% estrus response reported by Panicker *et al.* (2015) ^[16] in Malabari crossbred goats. Whereas, higher estrus response of 100% was observed by Senthil Kumar *et al.* (2016) ^[15] in Tellicherry goats, Cinar *et al.* (2017) ^[4] in hair goats and Panjaitan *et al.* (2020) ^[11] in goats.

Estrus response rate in the present study by using PPG protocol was 80% where as higher estrus response was

observed by Bitaraf *et al.* (2007) ^[2] (97%) and 100% estrus response was observed by Riaz *et al.* (2012) ^[6] in Beetal and dwarf goats, Osman and Elzagaffi 2016 ^[10] in Desert goats, Vinayak Biradar *et al.* (2019) ^[1] in Malabari goats and Parmar *et al.* (2020) ^[12] in Surti goats.

The estrus response was 50% in the control group does which were not received any treatment in the present study. Whereas Dash *et al.* (2019) ^[5] reported 55% estrus response in Black Bengal does and Kavitha *et al.* (2018) ^[8] reported 70% estrus response in non descript control group does. 100% estrus response was observed by Parmar *et al.* (2020) ^[12] in Surti goats and Osman and Elzagaffi 2016 ^[10] in Desert goats. 88% estrus response was observed by Bowdridge *et al.* (2013) ^[3] in Boer goats.

Table 2: Effect of different estrus synchronization protocols on Estrus response rate

| Treatment | Estrus response rate (percentage) | Chi-square value |
|----------------------|-----------------------------------|--------------------|
| Control (n=20) | 50 (n=10) | 6.60* (p< 0.05) |
| GPG (n=20) (Ovsynch) | 80 (n=16) | |
| PPG (n=20) | 80 (n=16) | |

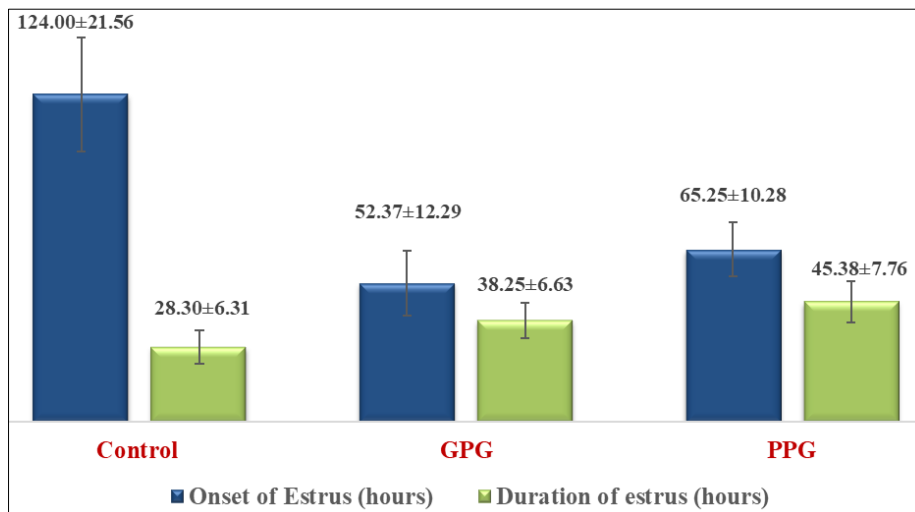


Fig 1: Mean observations of onset of estrus (hours) and duration of estrus (hours) in different Estrus synchronization protocols on local goats (Mean ± S.D.)

Effect of GPG & PPG protocols on reproductive performance

In the current findings in GPG protocol shown are 100% 1.31 and 31.2% of the kidding rate, prolificacy and twinning percentage (Table 3 & Figure 2). Kidding rate was in agreement with the findings of Cinar *et al.* (2017) [4] in hair goats. Whereas, Holtz *et al.* (2008) [7] reported lower kidding rate (58%). Higher prolificacy was recorded by Holtz *et al.* (2008) [7] as 1.86, Riaz *et al.* (2012) [6] as 1.6±0.2 and Cinar *et al.* (2017) [4] in Hair goats as 1.41.

The conception rate, kidding rate and litter size were 80%, 100% and 1.37 respectively in the present study in PPG protocol (Table 3 & Figure 2). Twinning percentage recorded was 37.5%. Conception rate was in agreement with the findings of Omontese *et al.* (2013) [9] in Red sokoto does and Riaz *et al.* (2012) [6] in Beetal and dwarf does. Conception rate of 95% was recorded by Cinar *et al.* (2017) [4] in Hair goats and 100% pregnancy was observed by Osman and Elzagaffi 2016 [10] in Desert goats. Whereas, lower conception

rate was recorded by Parmar *et al.* (2020) [12] in Surti goats (44.4%), Biradar *et al.* (2019) [11] in Malabari goats (69.23%). Similar kidding rates were recorded by Parmar *et al.* (2020) [12] in Surti goats (100%), Biradar *et al.* (2019) and Osman and Elzagaffi 2016 [10] in Desert goats. Bitaraf A *et al.* (2007) [2] reported litter size as 1.44±0.2 in Nadooshani goats, Riaz *et al.* (2012) [6] in Beetal and dwarf does as 1.6±0.2, Cinar *et al.* (2017) [4] in Hair goats as 1.40. 25% twinning rate was reported by Parmar *et al.* (2020) [12] in Surti goats.

The pregnancy rate, kidding rate and twinning percentage was 50, 80, and 25% respectively in control group of does (Table 3 & Figure 2). The average litter size was 1.25. Higher pregnancy rates were recorded by Kavitha *et al.* (2018) [8] as 52.40%, Dash *et al.* (2019) [5] as 63.6%, Parmar *et al.* (2020) [12] as 55.5%, Bowdridge *et al.* (2013) [3] as 53%, Sen and Hasan Onder, 2015 [14] as 76% and Osman and Elzagaffi, 2016 [10] as 100%. Kidding rate of 100% was reported by Parmar *et al.* (2020) [12]. Twinning rate of 40% was reported by Parmar *et al.* (2020) [12] in surti goats.

Table 3: Effect of different estrus synchronization protocols on reproductive performance

| Treatment | Conception rate (percentage) | Kidding percentage | Average Litter size | Twinning percentage |
|----------------------|------------------------------|--------------------|---------------------|---------------------|
| Control (n=20) | 50 (n=10) | 80 (n=8) | 1.25 (10/8) | 25 (2/8) |
| GPG (n=20) (Ovsynch) | 80 (n=16) | 100 (n=16) | 1.31 (21/16) | 31.2 (5/16) |
| PPG (n=20) | 80 (n=16) | 100 (n=16) | 1.37 (22/16) | 37.5 (6/16) |

n - Number of animals

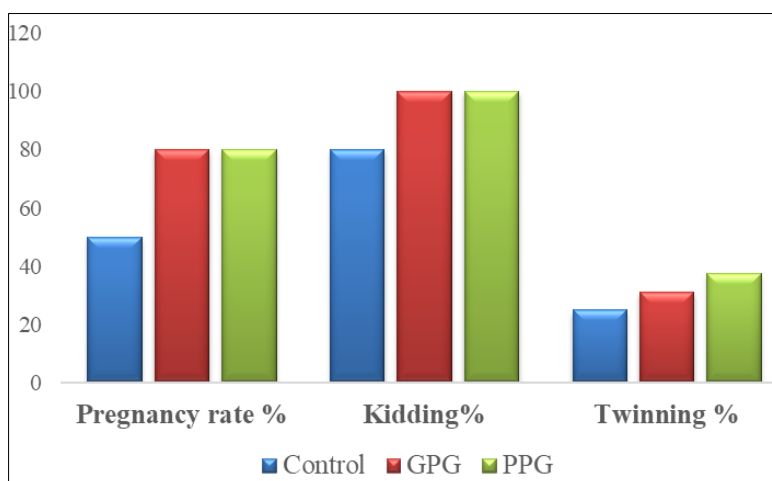


Fig 2: Effect of different estrus synchronization protocols on reproductive performance of local goats

Conclusion

The present study revealed that, the estrus synchronization protocols are showing significant effect on onset of estrus, estrus response rate and duration of estrus. The GPG and PPG protocols have reduced the time taken for the onset of estrus, while PPG protocol reflected higher duration of estrus which could be useful to improve the reproductive efficiency of small ruminants. The conception rate, litter size and twinning percentage are higher in GGP & PPG protocols than the control group is an indication of higher reproductive efficiency in the treated groups. Studies have to be conducted on large number of animals to confirm the efficacy of the treatment protocols for further confirmation.

Acknowledgments

Authors thank the higher authorities of PVNRTVU, Telangana for providing the necessary facilities and financial support throughout the research program. Thanks to In-charge Livestock Research Station for their help throughout the research work. We wish to acknowledge the hard work and sincerity of the staffs of the Livestock Research Station, Mahabubnagar.

Conflict of interest

The authors have no conflict of interest to declare.

Appendix

GnRH: Gonadotropin Releasing Hormone

PGF_{2α}: Prostaglandin F₂ Alpha

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