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E Sunil Anand Kumar
Assistant Professor, Department of Veterinary Gynaecology & Obstetrics, College of Veterinary Science, Rajendranagar, Hyderabad, Telangana, India

K Ramchandra Reddy
Assistant Professor, Department of Veterinary Gynaecology & Obstetrics, College of Veterinary Science, Rajendranagar, Hyderabad, Telangana, India

A Gopala Reddy
Assistant Professor, Department of Veterinary Gynaecology & Obstetrics, College of Veterinary Science, Rajendranagar, Hyderabad, Telangana, India

KBP Raghavavender
Assistant Professor, Department of Veterinary Gynaecology & Obstetrics, College of Veterinary Science, Rajendranagar, Hyderabad, Telangana, India

D Ashok Kumar
Assistant Professor, Department of Veterinary Gynaecology & Obstetrics, College of Veterinary Science, Rajendranagar, Hyderabad, Telangana, India

L Ramsingh
Assistant Professor, Department of Veterinary Gynaecology & Obstetrics, College of Veterinary Science, Rajendranagar, Hyderabad, Telangana, India

Correspondence
E Sunil Anand Kumar
Assistant Professor, Department of Veterinary Gynaecology & Obstetrics, College of Veterinary Science, Rajendranagar, Hyderabad, Telangana, India

Efficacy of estrus synchronization protocols on reproductive performance in goats

E Sunil Anand Kumar, K Ramchandra Reddy, A Gopala Reddy, KBP Raghavavender, D Ashok Kumar and L Ramsingh

Abstract
The present study was conducted to know the efficacy of best estrus synchronization protocols on reproductive performance in goats. Estrus synchronization is valuable reproductive and manage mental technique to breed the goats. Total 100 does were selected in the present study. All the goats were grouped into 5 groups of 20 each. The treatment protocols are control (group – 1), injecting PGF2α with 12 days apart (group-2), vaginal sponges which is treated with progesterone was impregnated into vagina for 12 days (group – 3), vaginal sponge for 12 days with PMSG at the time of removal of sponge (group – 4) and vaginal sponge + PMSG + GnRH at time of breeding (group – 5). All the animals in different groups were analysed for reproductive performance based on Pregnancy rate, Kidding rate, Litter size and Twinning rate. This present study results reveled that, the reproductive performance is high in group – 5 when compared with groups 2 and control.

Keywords: Estrus synchronization, Goats, vaginal sponges, PGF2α, PMSG, GnRH, reproductive performance, pregnancy rate, kidding rate, twinning rate

Introduction
Goat was the first animal to be domesticated by man and continue to hold an important niche particularly in subsistence agriculture in developing countries (Devendra and Solaiman, 2010). India has the largest goat population (18%) in the world. Goat plays an important role in Indian economy (8.5%) to livestock GDP) and source of livelihood and employment to millions of rural households (Kumar *et al*., 2011). Goat will not express clear-cut signs of oestrus, as seen in cattle and are mated arbitrarily. Estrus synchronization is one such valuable reproductive and managemental technique for producers to breed the goats at a definite time (Selvaraju*et al.,* 2014). Essentially there are two approaches for estrus synchronization in goats namely, artificial prolongation of diestrus using exogenous progesterone or progestagen or its shortening this phase by the use of luteolytic agents (Bretzlaff and Madrid, 1989). Estrus can be synchronized by intravaginal progestagen pessaries, progesterone implants or prostaglandins. 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 that are effective at lower dose levels than natural progesterone and are inserted in the vagina for 12-14 days. The most commonly used product for synchronization in goat is PMSG (eCG). One limitation of PMSG is its long-acting biological activity, causing it to continuously recruit antral follicles, which results in a large number of anouvulated follicles (Armstrong *et al*., 1983) [1], particularly when given at adose levels to induce super ovulation. Prostaglandin (PGF_2 α) based estrous synchronization systems control the estrous cycle by terminating the luteal phase through controlling the life span of CL. The use of pharmacological doses of GnRH in conjunction with intravaginal sponges to induce ovulation was evaluated by Robin *et al*. (1994) in dairy goats. A single injection of GnRH (125µg) and a double injection (125µg in a 48 hrs interval) at sponge (MAP, 60mg, 14d) removal. Pregnancy rate was also lower in does receiving single and double injections of GnRH than in does treated with PMSG (0 and 12% vs 57%, respectively).
Though there are different protocols for estrus induction in goats, the information on cost effective, farmer-oriented and field applicable estrus induction protocols are scanty. 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 reproduction by controlling estrus cycles artificially by inducing vaginal sponges, PMSG, GnRH injections at different doses.

Materials and Methods

The present investigation was undertaken at the Instructional Livestock Farm Complex (ILFC), College of Veterinary Science Rajendranagar, Hyderabad, Livestock Research Institute, Mahbubnagar and in field flocks of Ranga Reddy district in collaboration with the Department of Animal Husbandry, Telangana state. The Does stationed at Livestock Research Institute, Mahbubnagar and field flocks maintained by private farmers were utilized for the study. The Does were housed in thatched roof sheds with mud flooring. The Does were allowed for grazing in the fields and fed on sufficient green fodder and concentrate feed as per the nutritional requirements. Does were vaccinated against ET, PPR, FMD and dewormed prior to the study.

A total of 100 healthy and Does aged about 2 to 5 years (60 days post partum) belonging to different flocks were selected and studied. All the animals were palpated abdominally to diagnose pregnancy and in some animals pregnancy verification was done by ultrasonography using a B-mode ultrasound scanner* with 5 to 7.5 MHz convex transducer transabdominally.

A total of 100 does aged between 2 to 5 years will be utilized for the present study. The selected does will be divided into 5 groups in such a manner that each group consists of 20 does.

Group 1:- comprised of 20 Does that served as untreated controls and termed as "Control" group. These Does were used as untreated controls to enable comparison with the animals treated with $PGF_2\alpha$, impregnated progesterone intra-vaginal sponges, Vaginal sponges with PMSG and Vaginal sponges with PMSG + GnRH.

Group 2:- The Does were administered double PGF 2α injection with an interval of 12 days apart.

Group 3:- Goats were implanted with vaginal sponges impregnated with progesterone for 12 days continuously. All the sponges were removed from intra-vaginal after 12 days.

Group 4:- Does were implanted with Vaginal sponges for a period of 12 days and at the time of removal of sponges all the Does were given a dose of PMSG (Folligon) @ 300 IU was administered intramuscularly.

Group 5:- Does were implanted with intra-vaginal sponges for 12 days and 300 IU of PMSG was injected intramuscularly at the time of removal of sponges and 10 µg of GnRH (Receptol) at the time of breeding was given.

Does of all groups were monitored for the symptoms of estrus by using a teaser buck daily 4 times with an interval of 6 hours for the duration of 30 minutes for five days after withdrawal of intra vaginal progesterone sponges. Estrus signs were recorded by observing the Does behavior to the teaser ram.

The Does were subjected to pregnancy diagnosis by using trans-abdominal approach of real time B-mode ultrasonography @ 5 to 7.5 MHz multifrequency sector array probe was used for scanning of abdomen. The lower abdominal region of the Does was shaved before submitting them for scanning. The scanning procedure was started after day 45 of mating.

The Does were diagnosed as pregnant based on the visualization of an enlarged uterine lumen with amniotic fluid, which appeared as an anechoic area near the anechoic zone of urine filled bladder. Pregnancy was also diagnosed on the basis of visualization of echoic embryo within the amniotic cavity, placentomes and fetal skeleton (Ganaie *et al.*, 2009) [3].

The efficacy of estrus synchronization treatment protocols was measured in terms of pregnancy rate, kidding rate, litter size and twinning rates in pregnant does.

Pregnancy Rate

The pregnancy rate was calculated by the total number of Does kidding divided by the total number of Does mated multiplied by hundred as per the method described by M.G. Sahare *et al.* (2009). The pregnancy rate was expressed in terms of per cent.

Kidding Rate

The lambing rate was calculated by the total number of kids born divided by total number of Does mated multiplied by hundred as per the method adopted by Zeleke *et al.* (2005). The kidding rate was expressed in terms of per cent.

Litter Size

The litter size was calculated by total number of kids born divided by the total number of Does kidding as per method adopted by Zeleke *et al.* (2005).

Twinning Rate

The twinning rate was calculated by the total number of twin kids divided by the total number of kids multiplied by hundred as per method described by M.G. Sahare *et al.* (2009). The twinning rate was expressed in terms of per cent.

Statistical Analysis: The data collected was subjected to suitable statistical procedures as described by Snedecor and Cochran (1994).

Results & Discussion

The results of the present study on various estrus synchronization protocols in different groups of local does are presented in this section. Comparison was made between the groups on different days of treatment. The efficacy of protocol was expressed in terms of pregnancy rate, kidding rate, Litter size and multiple births and presented in table.

Pregnancy Rate

The pregnancy rate (%) was 33.33 in the control group 1 and the group 2 does treated with double $PGF_2\alpha$ in 12 days shown the pregnancy rate as 64.28. In group 3 does impregnated with intra vaginal sponges for 12 days, the pregnancy rate was 75.00. The pregnancy rate was 81.25 in the local does of group 4 does impregnated with vaginal sponges for 12 days and 300 IU of PMSG at the time of removal of sponges and the group 5 does impregnated with vaginal sponges for 12 days + 300 IU of PMSG at the time of removal of sponges + GnRH 10µg at the time of breeding showed the pregnancy rate as 84.21 (Table 1 & Fig. 1). The pregnancy rates were higher in does treated with different estrus synchronization protocols as compared to control group 1.

Kidding Rate

The kidding rate (%) was 33.33 in control group 1 and in the group 2 does treated with double $PGF_2\alpha$ in 12 days apart, the kidding rate was 78.57. In group 3 does impregnated with intra vaginal sponges for 12 days, the kidding rate was 91.66. The kidding rate was 106.25 in the group 4 does that were impregnated with vaginal sponges for 12 days and 300 IU of PMSG at the time of removal of sponges and the group 5 does impregnated with vaginal sponges for 12 days + 300 IU of PMSG at the time of removal of sponges + GnRH 10µg at the time of breeding showed the kidding rate as 126.31 (Table 1

& Fig. 2). The kidding rates were higher in does treated with different estrus synchronization protocols as compared to control group 1.

Litter Size

The litter size was 1.00 in control group and in group 2, where the local does treated with double $PGF_2\alpha$ in 12 days apart was shown the litter size was 1.22. In local does of group 3 impregnated with intra vaginal sponges for 12 days, the litter size was 1.22. The litter size was 1.30 in the group 4 does impregnated with vaginal sponges for 12 days and 300 IU of PMSG at the time of removal of sponges and the group 5 does that were impregnated with vaginal sponges for 12 days + 300 IU of PMSG at the time of removal of sponges + GnRH 10µg at the time of breeding showed the litter size as 1.50 (Tab 1 & Fig. 3). The litter size was higher in does treated with different estrus synchronization protocols when compared to control group 1.

Twinning Rate

The twining rate per cent (%) of does in control was 0.00 and the per cent of twining rate in group 2, where the local does treated with double $PGF_2\alpha$ in 12 days apart, was 18.18. Twining rate of does in group 3 was 18.18, in which the local does were impregnated with vaginal sponge for 12 days continuously. In group 4 does impregnated with vaginal sponges for 12 days and 300 IU of PMSG at the time of removal of sponges the twinning rate was 23.52, while it was 33.33 in group 5 does that were impregnated with vaginal sponges for 12 days + 300 IU of PMSG at the time of removal of sponges + GnRH 10µg at the time of breeding (Tab. 1 & Fig. 4).

Table 1: Pregnancy rate, Kidding rate, Litter size and Twinning rate between groups and days of treatment in Synchronized Local Does

Group No	Treatment Protocols	Does kidding / mated	Pregnancy Rate (%)	Kids born / Does mated	Kidding Rate (%)	Kids born / Does kidding	Litter Size	Twin kids / no. of kids	Twinning Rate (%)
1	Control	2/6	33.33	2/6	33.33	2/2	1.00	0/2	0.00
2	$PGF_2\alpha$	9/14	64.28	11/14	78.57	11/9	1.22	2/11	18.18
3	Vaginal Sponge	9/12	75.00	11/12	91.66	11/9	1.22	2/11	18.18
4	Vaginal sponge + PMSG	13/16	81.25	17/16	106.25	17/13	1.30	4/17	23.52
5	Vaginal sponge + PMSG + GnRH	16/19	84.21	24/19	126.31	24/16	1.50	8/24	33.33

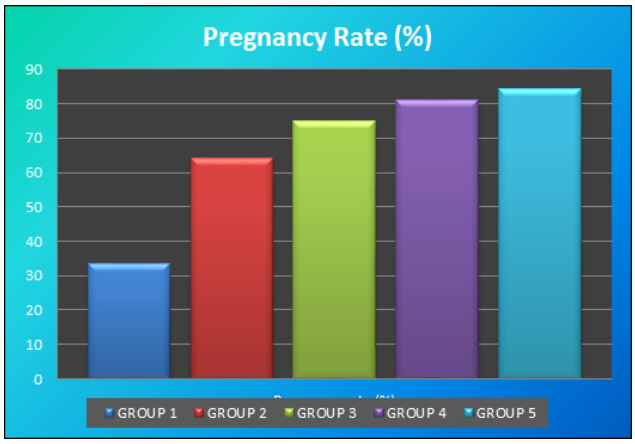

Fig 1: Pregnancy Rate (%) in Does synchronized with different treatments

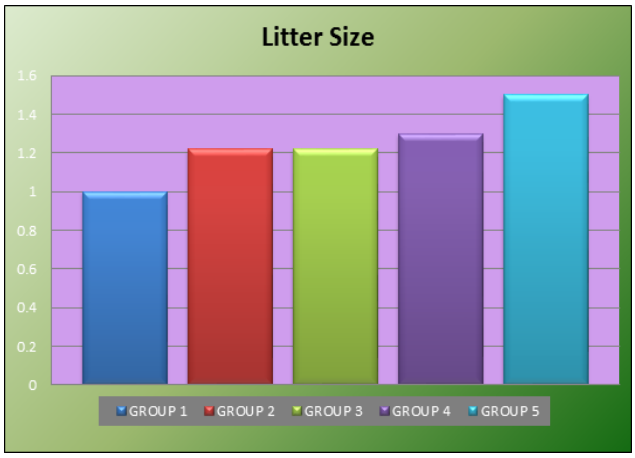

Fig 3: Litter size of Does synchronized with different treatments

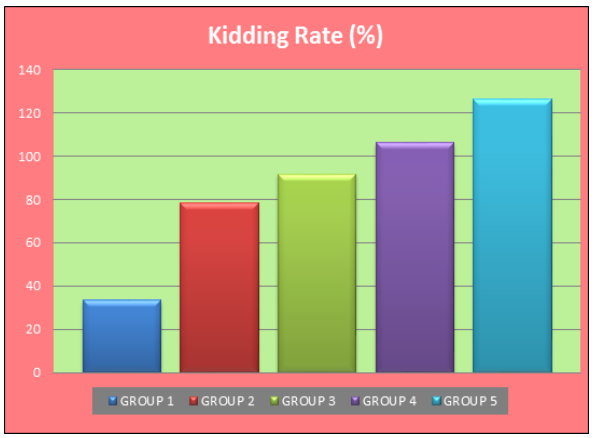

Fig 2: Kidding Rate (%) in Does synchronized with different treatments

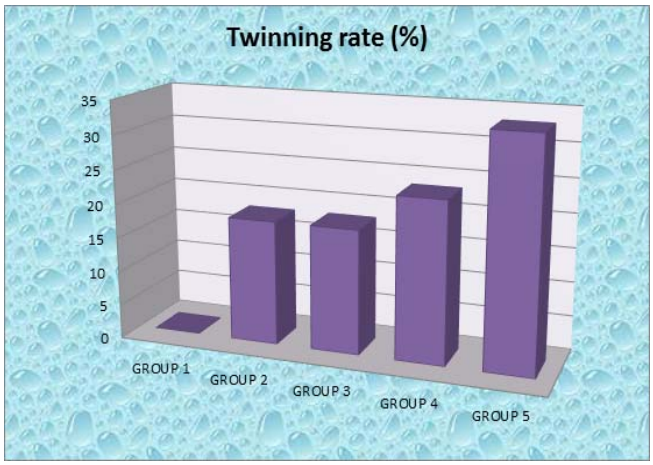

Fig 4: Twinning Rate (%) of Does synchronized with different treatments

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