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#### Suhas Suresh

MVSc Scholar, Department of Veterinary Gynaecology and Obstetrics, Veterinary College, Hebbal, KVAFSU, Bengaluru, Karnataka, India

#### Sahadev Annayappa

Professor and Head, Department of Veterinary Gynaecology and Obstetrics, Veterinary College, KVAFSU, Bengaluru, Karnataka, India

#### Narasimhamurthy

Assistant Professor, Department of Veterinary Gynaecology and Obstetrics, Veterinary College, KVAFSU, Bengaluru, Karnataka, India

#### Narayana Swamy Muniyappa

Professor and Head, Department of Veterinary Physiology, Veterinary College, KVAFSU, Bengaluru, Karnataka, India

#### Guruprasad Rachaiah

Principal, Animal Husbandry Polytechnic, KVAFSU, Hassan, Karnataka, India

#### Santhosh Chikkaankadahalli Ramachandra

Assistant Professor, Department of Veterinary Pharmacology and Therapeutics, Veterinary College, KVAFSU, Bengaluru, Karnataka, India

#### Suchitra Bidare Raju

Assistant Professor, Department of Veterinary Gynaecology and Obstetrics, Veterinary College, KVAFSU, Bengaluru, Karnataka, India

#### Rashmi Srinivas

Assistant Professor (JC), Department of Veterinary Gynaecology and Obstetrics, Veterinary College, KVAFSU, Bengaluru, Karnataka, India

#### Corresponding Author:

##### Suhas Suresh

MVSc Scholar, Department of Veterinary Gynaecology and Obstetrics, Veterinary College, Hebbal, KVAFSU, Bengaluru, Karnataka, India

## Reproductive parameters of Hassan breed of ewes under controlled reproduction

**Suhas Suresh, Sahadev Annayappa, Narasimhamurthy, Narayana Swamy Muniyappa, Guruprasad Rachaiah, Santhosh Chikkaankadahalli Ramachandra, Suchitra Bidare Raju and Rashmi Srinivas**

### Abstract

The objective of present study was to document various reproductive parameters in Hassan ewes using various estrus synchronization protocols. Thirty apparently healthy non-pregnant Hassan ewes were randomly assigned to three groups with ten each. The ewes were estrus synchronized using Avikesil-S® intra-vaginal sponge for seven days followed by 125 µg cloprostenol, on day of sponge retrieval. In Group I, ewes received 300 IU PMSG on the same day, ewes of Group II received 4 µg busserelin acetate, 36 h thereafter and Group III ewes received 300 IU PMSG on day of sponge removal and 4 µg busserelin acetate 36 h post sponge withdrawal. The treated ewes were monitored until lambing with pregnancy diagnosis using ultrasonography on day 30 post mating and results were recorded. The duration of estrus, gestation period, lambing rate, litter size, sex ratio and birth weight did not differ significantly among the treated groups. The estrus duration, gestation length, lambing rate, litter size, sex ratio and birth weight of lambs, respectively were 30.22 ± 1.18 h, 151.54 ± 0.43 days, 100 percent, 1, 66.67:33.33 percent and 3.04 ± 0.07 kg.

**Keywords:** Hassan ewes, estrus synchronization, AVIKESIL-S®, reproductive parameters

### Introduction

India is best owed with vast ovine genetic diversity and the sheep population in country is 74.26 million as per 20<sup>th</sup> livestock census (BAHS, 2019) [4]. Sheep population in Karnataka is 11.05 million during 20<sup>th</sup> livestock census (2019). Out of 44 recognized sheep breeds in India four breeds are from the state of Karnataka. Hassan breed of sheep are distributed in Hassan and the adjoining districts. These sheep are very hardy with medium and drooping ears, females are usually polled (39 per cent of the males are horned), fleece is extremely coarse and legs and belly are generally devoid of wool (Anonymous, 2020) [2]. Many of the reproductive parameters of Hassan sheep are regrettably not attempted to document and hence, using estrus synchronization protocols reproductive performance of the Hassan sheep was documented in present study.

### Materials and Methods

The study was conducted in the Hassan breed of sheep maintained in University farm at Animal Husbandry Polytechnic, Koravangala, Hassan, Karnataka, India. This study was conducted during March, 2020 to August, 2020. Thirty apparently healthy non pregnant ewes were randomly divided into three groups with ten each and were subjected to different estrus synchronization protocols using Avikesil-S® intravaginal sponge kept *in situ* for seven days followed by intramuscular administration 125 µg cloprostenol at removal. On day of sponge withdrawal, ewes in Group I, received 300 IU eCG (Folligon® 1000 IU) intramuscularly, in Group II, 4 µg busserelin acetate (Receptal® 10 mL, 4 µg/mL) administered intramuscularly 36 h thereafter. While in Group III at the time of sponge removal 300 IU eCG administered and followed by 4 µg busserelin acetate administered intramuscularly 36 h of sponge withdrawal. Estrus signs were monitored twice daily for 30 minutes each time (06:00 - 06:30 and 18:00 - 18:30) for estrus response after sponge withdrawal with the help of teaser ram equipped with colour marking on the brisket. The ewe which stands to be mounted was considered to be in estrus. The ewes detected in estrus by paint marking on rump were separated immediately from the flock and placed with proven one ram to five ewes for mating. The ewes were monitored until lambing.

On day 30 post breeding ewes were subjected for pregnancy diagnosis using real time, B-mode ultrasound scanner with linear array rectal transducer equipped with frequency of 4.0 to 8.5 MHz (Easi-scan, BCF Technology Ltd., UK) and again pregnancy diagnosis on 60 day post breeding either by trans-rectal or transabdominal ultrasonography was done to know embryonic mortality, if any. The various reproductive parameters were recorded and used to derive the parameters as per the method described by Abdalla *et al.* (2014) [11] and Quintero-Elisea *et al.* (2011) [21]. The statistical analysis

performed using GraphPad prism software (version 8.4.3). The parametric reproductive traits like duration of estrus, gestation period, birth weight and litter size were subjected to one way ANOVA with post hoc Tukey's test at 0.05 level of significance and expressed as Mean  $\pm$  SE. While, other non-parametric data like lambing rate and sex ratio were analyzed with Chi-square test and expressed in percentage.

## Results and Discussion

**Table 1:** Effect of synchronization protocols on parametric reproductive traits in Hassan ewes (Mean  $\pm$  SE)

Parameter	Group I (n = 10)	Group II (n = 10)	Group III (n = 10)	Over all
Duration of estrus (h)	32.00 $\pm$ 2.00	28.00 $\pm$ 2.00	30.67 $\pm$ 2.11	30.22 $\pm$ 1.18
Gestation length (days)	151.30 $\pm$ 0.53	151.80 $\pm$ 0.73	152.80 $\pm$ 0.95	151.54 $\pm$ 0.43
Birth weight (kg)	3.03 $\pm$ 0.17	3.08 $\pm$ 0.11	3.03 $\pm$ 0.13	3.04 $\pm$ 0.07
Litter size	1	1	1	1

**Note:** Mean  $\pm$  SE bearing different superscripts are statistically different ( $p < 0.05$ )

**Table 2:** Effect of synchronization protocols on non-parametric reproductive traits in Hassan ewes

Parameter	Group I (n=10)	Group II (n = 10)	Group III (n = 10)	Over all
Sex ratio (Male: Female) (%)	71.43:28.57	60:40	66.67:33.33	66.67:33.33
Lambing rate (%)	100	100	100	100

The overall mean duration of estrus in Hassan breed of ewes is 30.22  $\pm$  1.18 h (Table 1) with range of 32.00 $\pm$ 2.00 to 30.67 $\pm$ 2.11 h and is within the physiological range of 24 – 36 h (Jainudeen *et al.*, 2000) [12]. Lombardo *et al.* (2020) [15] obtained similar estrus duration of 32.00  $\pm$  2.54 h in Lacaune ewes using MPA sponge for six days. Yadav *et al.* (2020) [27] reported lower estrus duration of 26.40  $\pm$  1.64 h in crossbred (Nali $\times$ Rambouillet) ewes using Avikesil-S<sup>®</sup> intravaginal sponge. This variation could be due to methods and frequency of estrus detection (Martinez-Ros and Gonzales-Bulnes, 2019) [17]. Other factors affecting estrus duration are ascribed to the dosage of gonadotropin, duration of progesterone treatment along with the difference in age and reproductive status of the ewes (Wildeus, 2000) [26].

The mean gestation period after estrus synchronization and natural service in Hassan breed of sheep was recorded as 151.54  $\pm$  0.43 days. Several authors reported similar gestation period in sheep under farm conditions which ranged from 149.54  $\pm$  0.06 to 155.53  $\pm$  0.49 days (Mishra *et al.*, 2004 [18]; Dass, 2007 [7]; Panda *et al.*, 2012 [20]; Kumar *et al.*, 2017 [13]). Zarkawi (2001) [28] reported that the eCG/GnRH treatment had no effect on gestation period. The slight variation in results of present study and reports of other researchers could be attributed to difference in breed of ewes, nutritional status during pregnancy and the climatic conditions (Farrag, 2019) [9]. The overall mean birth weight of Hassan lambs obtained in the present study was 3.04  $\pm$  0.07 kg with 3.08  $\pm$  0.10 kg ram lambs and 2.99  $\pm$  0.14 kg ewe lambs. Under natural mating in farm conditions, Siddalingamurthy *et al.* (2017) [23] reported lower mean birth weight of 2.14  $\pm$  0.02 kg in Mandya sheep which is lower than the study results. In Nellore  $\times$  Jodipi ewe, the mean birth weight of lambs has been reported as 3.03  $\pm$  0.01 kg by Reddy *et al.* (2018) [22] and 3.04  $\pm$  0.07 kg in Deccani sheep by Bangar *et al.* (2017) [5]. Thus, the reported birth weights of lambs of Nellore  $\times$  Jodipi and Deccani is almost similar to that of the Hassan breed. Various factors affecting birth weight of lambs includes flushing of ewes

during breeding (El-Hag *et al.*, 1998) [8], management, health, breed, litter size per ewe and sex of lamb (Momoh *et al.*, 2013) [19]. However, the treatment has no effect on the birth weight of lambs (Farrag, 2019) [9].

The overall litter size in current study is one. This corresponds to FAO report which stated that the litter size is one in Hassan sheep breed under farm conditions (Anonymous, 2020a) [3]. The dose of PMSG used might cause variations in ovulation response because of the genetic differences in ewes and thus resulting in increased litter size but no such variation was evident in the present study. There is a great variability in response that might be attributed to breed, individuals within the breed, season during which estrus synchronized, parity of ewe and general body condition of ewe (Boscos *et al.*, 2002 [6]; Quintero-Elisea *et al.*, 2011 [21]; Macías-Cruz *et al.* 2012 [16]).

The overall sex ratio of Hassan breed lambs born in the study was 66.67:33.33. Factors reported to affect sex ratio include timing of mating where early mating (in first half of estrus) appears to favor female lambs and late mating appears to favor male lambs (Gutierrez-Adan *et al.*, 1999) [11]. According to Lindstrom *et al.* (2002) [14], sex ratio of lamb is associated with population size in the year of conception and it is not affected by treatment, environmental factors or maternal phenotype. Further, the diet also affects sex ratio where higher total fat and amount of rumen-protected poly unsaturated fatty acid in feed during the breeding period alters sex ratio in favor of birth of male lambs (Green *et al.*, 2008) [10].

Cent per cent lambing rate in Hassan ewes was obtained in the study which is similar lambing rate reported in Awassi ewes (Zonturlu *et al.*, 2011) [29]. In Awassi ewes, Titi *et al.* (2010) [25] reported lower lambing rate of 87.00 percent in synchronized estrus. The flushing of ewes prior to mating season improves lambing rate (Farrag, 2019) [9]. The difference in lambing rate reported by others could be attributed to differences in body condition, breed and rearing systems followed (Tharwat *et al.*, 2020) [24].

## Conclusion

The overall estrus duration, gestation length, lambing rate, litter size, sex ratio and birth weight of lambs, respectively were 30.22  $\pm$  1.18 h, 151.54  $\pm$  0.43 days, 100 per cent, 1, 66.67:33.33 per cent and 3.04  $\pm$  0.07 kg in Hassan breed of sheep.

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**Conflict of interest:** Authors have no conflict of interest

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