Reproductive parameters of Hassan breed of ewes under controlled reproduction

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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 buserelin acetate, 36 h thereafter and Group III ewes received 300 IU PMSG on day of sponge removal and 4 μg buserelin 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 20th livestock census (BAHS, 2019) [1]. Sheep population in Karnataka is 11.05 million during 20th 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 regretfully 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 Husbandary 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 buserelin 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 buserelin 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 transrectal 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) [1] 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 ± 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 ± SE)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Group I (n = 10)</th>
<th>Group II (n = 10)</th>
<th>Group III (n = 10)</th>
<th>Over all</th>
</tr>
</thead>
<tbody>
<tr>
<td>Duration of estrus (h)</td>
<td>32.00 ± 2.00</td>
<td>28.00 ± 2.00</td>
<td>30.67 ± 2.11</td>
<td>30.22 ± 1.18</td>
</tr>
<tr>
<td>Gestation length (days)</td>
<td>151.30 ± 0.33</td>
<td>151.80 ± 0.73</td>
<td>152.80 ± 0.95</td>
<td>151.54 ± 0.43</td>
</tr>
<tr>
<td>Birth weight (kg)</td>
<td>3.03 ± 0.17</td>
<td>3.08 ± 0.11</td>
<td>3.03 ± 0.13</td>
<td>3.04 ± 0.07</td>
</tr>
<tr>
<td>Litter size</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
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</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Group I (n=10)</th>
<th>Group II (n=10)</th>
<th>Group III (n=10)</th>
<th>Over all</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex ratio (Male: Female) (%)</td>
<td>71.43:28.57</td>
<td>60:40</td>
<td>66.67:33.33</td>
<td>66.67:33.33</td>
</tr>
<tr>
<td>Lambing rate (%)</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
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</table>

The overall mean duration of estrus in Hassan breed of ewes is 30.22 ± 1.18 h (Table 1) with range of 32.00±2.00 to 30.67±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 ± 2.54 h in Lacaune ewes using MPA sponge for six days. Yadav et al. (2020) [27] reported lower estrus duration of 26.40 ± 1.64 h in crossbred (NalixRambuilet) ewes using Avikesil-S0 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 (Wildheus, 2000) [20].

The mean gestation period after estrus synchronization and natural service in Hassan breed of sheep was recorded as 151.54 ± 0.43 days. Several authors reported similar gestation period in sheep under farm conditions which ranged from 149.54 ± 0.06 to 155.53 ± 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 ± 0.07 kg with 3.08 ± 0.10 kg ram lambs and 2.99 ± 0.14 kg ewe lambs. Under natural mating in farm conditions, Siddalingamurthy et al. (2017) [23] reported lower mean birth weight of 2.14 ± 0.02 kg in Mandya sheep which is lower than the study results. In Nellore x Jodipi ewe, the mean birth weight of lambs has been reported as 3.03 ± 0.01 kg by Reddy et al. (2018) [22] and 3.04 ± 0.07 kg in Deccani sheep by Bangar et al. (2017) [5]. Thus, the reported birth weights of lambs of Nellore x 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) [10]. 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) [15]. 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 polyunsaturated 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 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 ± 1.18 h, 151.54 ± 0.43 days, 100 per cent, 1, 66.67:33.33 per cent and 3.04 ± 0.07 kg in Hassan breed of sheep.
Acknowledgement
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Conflict of interest: Authors have no conflict of interest

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