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**Original Paper**

# Impact of Short-Term of Estrous Synchronization on Some Reproductive Performance Characteristics in Awassi Sheep

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The hormonal protocol is used to increase reproductive efficiency in ewes. The aim of the study was to investigate the effects of two intervals of hormonal protocol (progesterone + equine chorionic gonadotropin (P4 + eCG)) for estrus synchronization in Awassi ewes. A total of 110 Awassi ewes were randomly divided into two groups. The first group (short term) ($n$ = 45) used sponges for 7-day. The second group (long term) ($n$ = 65) used sponges for a 14-day. At the time of sponge withdrawl, two doses of eCG injection were administrated intramuscularly (500; $n$ = 54 and 1000 IU; $n$ = 56) for each main group. All ewes were mated with ram following estrous sings. Transabdominal ultrasonography was used for pregnancy diagnosis on 35- and 40-days following mating. Percentage of estrus response, conception rate, fertility rate, prolificacy rate twinning rateand missing rate were calculated for each group. Estrus response, fertility rate, conception rate, and low missed rate was greater in high dose eCG comapred to low dose. Estrus response, fertility rate, conception rate, twinning rate, litter size was greater in high dose and short-term group (100%, 100%, 100%, 19.2, and 0%) comparted to other groups. The estrus response, fertility rate, conception rate, twinning rate, litter size was greater in high dose and short-term group comparted to other groups. In addition to that missed rate was the lowest on high dose and short-term group comparted to other groups. In conclusion, a short-term treatment (7 days) for the induction of estrus can be a good alternative to a traditional longer duration treatment (14 days). Short-term priming has the advantage of allowing more flexibility in the treatment protocol under field conditions.

**Keywords:** Awassi ewes, estrus synchronization, eCG, fertility rate, litter size

## 1 Introduction

Reproductive efficiency plays a major role in an animal's farm productivity and economic sustainability by ensuring a stable and consistent supply of offspring for the production of meat, dairy, and fiber (Habeeb & Kutzler, 2021). The ability of animal herds production is directly impacted by many variables such as conception rates, litter sizes, and calving intervals. To maximize conception rates and reduces reproductive losses, effective reproductive management techniques are crucial e.g. timely estrous synchronization (Brito et al., 2021)

The estrous synchronization is performed by inserting an external device containing pregnancy hormone (progesterone) to prevent the appearance of estrus (9–19 days), combined with equine chorionic gonadotropin (eCG; FSH like) administration, at the time of device withdrawal, for ovulation induction and initiate the appearance of estrus within 24–48 h (Habeeb & Kutzler, 2021; Martinez-Ros et al., 2019). A number of techniques are used, including the use of intravaginal devices and hormonal therapies, with the goal of promoting estrous induction and synchronization to achieve consistent breeding and lambing seasons in a flock (Skliarov et al., 2021). However, fertility, estrus behavior, and productivity of the ewes could be differed according to eCG dose and time of progesterone treatment (Habeeb et al., 2023; Ince & Karaca, 2009). Research conducted by (Kleemann & Walker, 2005) has shown that sheep's ovarian response to estrus synchronization differs according to the period of progesterone treatment. A study conducted to evaluate the use of control induce Drug release (CIDR) for 5 and 12 days. The results showed a significant increase

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in estrus signs (79% and 66%), and ovulation rate (3.3 and 2.2), respectively, during non-breeding season in 5 days CIDR compare to 12 days (Knights et al., 2001). In addition, a study conducted to compare two period progesterone treatment (fluorogestone acetate; FGA) 4 and 12 days with or without 500 IU eCG at the time of progesterone withdrawal. The results showed that prolonge progesterone treatment (12 days) may resulted in decrease fertility compare to short treatment (4 days) with improve estrous synchronisation (Husein et al., 2007), lower the risk for vaginal health, and facilitate the reproductive management (Martinez-Ros et al., 2018).

eCG is crucial for estrous synchronizing and ovulation with different eCG dose in ewes. Pelibuey ewes treated with different eCG dose (500–4000 IU), one day before Syncro-mate-B (SMB) implants removal (10 d), resulted in greater ovulation rate (80%) for 2000 IU compared to other doses (González-Reyna et al., 1999). Dorper ewes treated with 500 IU eCG during the non-breeding season at the time of sponges withdrawal (12 days) resulted in pregnancy rate (60%) compared to nontreated ewes (Martinez-Tinajero et al., 2011). In addition, haired ewe treated with 400 IU resulted an increase in fertility rate and litter size (81% and 177.2%) respectively, compared to 100 and 200 IU eCG (Quintero-Elisea et al., 2011). Accordingly, the current study was conducted to evaluate the effect of a short and long period of estrus synchronization using intravaginal sponges treatment treated with either 500 IU or 1000 IU eCG on reproductive performance of Awassi ewes during the non-breeding season.

## 2 Material and Methods

A total of 110 healthy Awassi ewes (3–5 years old, weigh range 45–55 kg) was used in this study. Estrous synchronization was conducted in all ewes by intravaginal sponges (HIPRA, Spain) and equine chorionic gonadotropin (eCG) (HIPRA, Spain). All ewes were divided into 2 groups according to sponge's treatment intervals; 14 days (14D) ($n = 65$) and 7 days (7D) ($n = 45$). At the time of sponge withdrawl, two doses of eCG injection were administrated intramuscularly (500; $n = 54$ and 1000 IU; $n = 56$) for each main group. Estrous signs were identified, for each ewe, by introducing a ram teaser with harness and ram was intorduce to the ewe following estrus sings. Percentage of estrus response was calculated for each group (number of ewes showing estrus/total ewes treated × 100). Trans abdominal ultrasonographie (Chison, Hamburg, Germany) was examined for each animal and conception rate was recorded on day 40 and 45 postmating and AI for each animal. Conception rate (number of pregnant ewe/Numbers of mated ewes × 100) was calculated for each group. Fertility rate was recorded for each animal and fertility rate (number of lambed ewes/number of ewes exposed to rams × 100) was calculated for each group. Prolificacy rate (number of lambs born/number of ewe lambed × 100) was recorded for each animal and percentage of prolificacy was calculated for each group. Twinning rate (number of twin Lamb/lambed ewes × 100) was recorded for each ewe and percentage of twinning rate was calculated for each group. Litter size was recored for each animal was recorded (number of lambs born/number of ewes lambed). Missing rate was recorded for each animal and the percentage of missing rate was calculated for each group (100 – Fertility rate). The Statistical Analysis System – SAS (SAS, 2012) (ver.9.1) program was used for statistical analysis to detect the effect of three factors in studied parameters. Chi-square test was used for estrous response, fertility rate, conception rate, prolificacy rate, twining rate, and missed rate. Analysis of Variance (ANOVA) was used in this study for litter size and Duncan's multiple range test was used to compare between means (Duncan, 1955).

## 3 Results and Discussion

### *3.1 Effect of Short- and Long-Term Estrous Synchronization Protocols on Reproductive Performances Traits*

The statistical analysis showed that there was no significant difference between two estrous synchronization protocols (short term = 7 D, and long term= 14 D), two types of service, in estrus response, fertility rate, conception rate, prolificacy, twinning rate, litter size, and missed rate (Table 1), respectively. Progesterone based protocols, have been used as a standard method in estrus synchronization practice (Bretzlaff & Romano, 2001). In sheep, the intravaginal pathway was used to deliver the exogenous progesterone efficiently utilizing drugs-releasers either from polyurethane (sponges) (Robinson, 1965) silicon (CIDRs) (Wheaton et al., 1993). The drugs-releasers implanted devices mimic the corpus lutium role by releasing the progesterone hormones inhibiting the hypothalamus – pituitary axis. On another hand, the statistical analysis showed there was a significant difference between two doses of eCG in estrus response, fertility rate, conception rate, and missed rate (Table 2), respectively. High doses of eCG was greater in estrus response, fertility rate, conception rate, but the lowest missed rate. Equine chorionic gonadotropin (eCG) is one of the widely used gonadotrophines in estrus synchronization protocoles. Many studies documented a dose-dependent mannner in response for the eCG adminstration (Timurkan and Yildiz, 2005).

**Table 1** Effect of short- and long-term estrous synchronization protocols on reproductive performances traits

| Reproductive traits | 14 D, *n* = 65 long term | 7 D, *n* = 45 short term | *P*-value |
|---|---|---|---|
| Estrous response (%) | 87.6 | 95.5 | 0.347 NS |
| Fertility rate (%) | 87.6 | 95.5 | 0.347 NS |
| Conception rate (%) | 87.6 | 95.5 | 0.347 NS |
| Prolificacy rate (%) | 105.2 | 118.6 | 0.075 NS |
| Twinning rate (%) | 5.2 | 19.5 | 0.075 NS |
| Litter size # | 1.0 ±0.00 | 1.18 ±0.17 | 0.629 NS |
| Missed rate (%) | 12.4 | 4.5 | 0.347 NS |

NS – non-significant.; # – ANOVA test

**Table 2** Effect of two doses of eCG on reproductive performance traits

| Reproductive traits | Low doses *n* = 54 | High doses *n* = 56 | *P*-value |
|---|---|---|---|
| Estrous response (%) | 83.3b | 94.6a | 0.0417 * |
| Fertility rate (%) | 83.3 | 94.6 | 0.0417 * |
| Conception rate (%) | 83.3 | 94.6 | 0.0417 * |
| Prolificacy rate (%) | 108.8 | 116.9 | 0.095 NS |
| Twinning rate (%) | 7.4 | 12.5 | 0.126 NS |
| Litter size # | 1.08 ±0.09 | 1.16 ±0.15 | 0.095 NS |
| Missed rate (%) | 16.77 | 5.4 | 0.0417 * |

* *P* ≤0.05; NS – non-significant.; # – ANOVA test

### *3.2 Effect of Two Doses of eCG in Short and Long Term on Reproductive Performance Traits*

In this study, the estrus response, fertility rate, conception rate, twinning rate, litter size was greater in high dose and short-term group comparted to other groups Tabel (3). In addition to that missed rate was the lowest on high dose and short-term group comparted to other groups Tabel (3). The reproductive parameters for Awassi sheep undergoing estrous synchronization with short-term and long-term are describe in the table 3. The highest levels of progesterone were reordered 4–5 days after CIDRs insertion, and then declined to sub-luteal levels that is enough to block ovulation. Insertion CIDRs for longer period may extend the blocking effects of the sub-luteal levels of progesterone and consequently effect the fertility parameters in the treated ewes (Menchaca and Rubianes, 2004). Many studies concluded that outcome in the short protocol was superior than in the long protocol (Viñoles et al., 1999).

When compared with lower dosages in two groups led to significantly higher estrus response, fertility, and conception, as well as reduced missed rates (P≤0.01). But there was no statistically significant difference in the prolificacy, twinning, or litter size rates between the two dosage groups. In addition, our data shows lower dose eCG at the end of long-term progesterone treatment as more effective as low dose of eCG in most

**Table 3** Effect of two doses of eCG in short and long term on reproductive performance traits

| Reproductive traits | 14 D = long terrm | | 7 D =short term | | *P*-value |
|---|---|---|---|---|---|
| | low dose, *n* = 35 | high dose, *n* = 30 | low dose, *n* = 19 | high dose, *n* = 26 | |
| Estrous response (%) | 77.1 | 69.6 | 89.4 | 100 | 0.0085 ** |
| Fertility rate (%) | 77.1 | 69.6 | 89.4 | 100 | 0.0085 ** |
| Conception rate (%) | 77.1 | 69.6 | 89.4 | 100 | 0.0085 ** |
| Prolificacy rate (%) | 107.4 | 106.8 | 117.6 | 119 | 0.081 NS |
| Twinning rate (%) | 3.7 | 6.9 | 20 | 19.2 | 0.038 * |
| Litter size # | 1.0 ±0.00 | 1.0 ±0.0 | 1.1 ±0.00 | 1.1 ±0.04 | 0.804 NS |
| Missed rate (%) | 22.9 | 30.4 | 10.6 | 0 | 0.0085 ** |

* *P* ≤0.05, ** *P* ≤0.01, NS – non-significant; # – ANOVA test

of studied parameters. In another hand, high dose of eCG in short term progestagen founds more effectively in estrus response, fertility, conception and prolificacy rate than long term p4. Our finding shows raised twinning rate with high doses of eCG in long term progestagen, but in short term, it raises when low eCG administered. According to (Roshan et al., 2023), Fertility and production were higher in ewes synchronized when 400 IU of eCG was administered as compered with 300 IU in Lacaune ewes. It is concluded that 400 IU eCG can be as effective as 600 IU eCG in sexual stimulation of Kangal ewes in anestrus (Takcı et al., 2023).

## 4 Conclusions

The short-term progestagen protocol can be advised for Awassi ewes due to its short treatment period, lower drug price, high reproductive performance and easy application. It can be concluded that both techniques produce results that are comparable in terms of reproductive performance characteristics like the estrous response, fertility, conception rate, Prolificacy, and twinning rate. These results imply that sheep farmers looking to maximize reproductive success in their flocks may consider both AI and natural breeding as viable choices. However, greater investigation into elements including labor needs, long-term reproductive results, and cost-effectiveness might yield more thorough recommendations for sheep management techniques. Additionally, customized strategies can be required depending on particular production goals and restrictions, taking into account the variation in outcomes across various research and environmental situations. Thus, a short-term progestagen treatment (7 days) for the induction of estrus can be a good alternative to a traditional longer duration treatment (14 days). Short-term priming has the advantage of allowing more flexibility in the treatment protocol under field conditions.

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