Induction of synchronized oestrus in akkara-man cross-bred ewes during breeding and anoestrus seasons: the use of short-term and long-term progesterone treatments

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SUMMARY

The objective of this trial was to compare the efficacy of short-term and long-term progesterone treatments to induce ovarian activity of sheep both during breeding and anoestrus seasons. The experiment was performed at two periods, during the breeding and the anoestrus seasons on 2 different groups of 30 ewes. During each period, the ewes were randomly allocated to 2 groups of 15 ewes which received a short term (7 days) or a long term (12 days) progesterone treatment, respectively. The progesterone treatment consisted on a vaginal sponge containing 30 mg fluorogestone acetate (FGA) inserted into the vagina of the ewes for 7 or 12 days. Triaprost tromethamine, an analogue of PGF2α, was intramuscularly administered to all ewes at the moment of the sponges withdrawal. Afterwards, 400 IU of PMSG were intramuscularly administered to all the ewes. Mean percentage of estrous, pregnant and lambing sheep were 100%, 86.7% and 80% in both the short term and the long term treated groups (1.8 vs 1.7). During the anoestrus season, the mean percentage of estrous, pregnant, lambing sheep and mean litter size were 86.6%, 76.9%, 61.5% and 1.5 in the long term treated group and 93.3%, 85.7%, 71.4% and 1.5 in the short term treated group, respectively. The short-term progesterone treatment was effective to synchronize oestrus in sheep during both breeding and anoestrus seasons.

Keywords: Estrus synchronization - progesterone - anoestrus - ewes.

Introduction

Most sheep breeds in the central climatic zones are seasonal polyoestrous animals. The estrus season starts in autumn and lasts until spring [24]. Progestagen and prostaglandin analogues are widely used in sheep for estrus synchronization [2]. Prostaglandin-based estrus synchronization systems control the estrus cycle by terminating the luteal phase through regression of the corpus luteum. This approach is only applicable in cyclic female and hence, prostaglandin-based systems can only be used during the breeding season. Because not all stages of the estrus cycle are similarly receptive to prostaglandin treatment, a double injection system with an interval of 11 days is the most widely used approach in small ruminants [11].

Intravaginal sponges containing progesterone are one of the most applied treatments for estrus synchronization in small ruminants during the breeding and non-breeding season. Intravaginal sponges are usually inserted over periods of 12 to 14 day and used together with PMSG, particularly out of season, administered at the time of sponge withdrawal or 48 hours prior to sponge removal [11].

RÉSUMÉ

Études comparatives de deux traitements de l’anoestrus chez la brebis.

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L’objectif de cette étude était de comparer l’efficacité de 2 traitements à la progesterone de durées différentes sur l’induction et la synchronisation de l’activité ovarienne des brebis au cours de la saison sexuelle et de l’anoestrus saisonnier. L’expérience a eu lieu au cours de 2 périodes, la saison sexuelle et l’anoestrus saisonnier sur 2 lots différents de 30 brebis. Au cours de chaque période, les brebis ont été reparties de façon aléatoire en 2 lots de 15 brebis qui ont reçu respectivement un traitement à la progesterone de courte durée (7 jours) ou un traitement de plus longue durée (12 jours). Le traitement à la progesterone consistait en la mise en place d’une épingle vaginale imprégnée avec 30mg d’acétate de fluorogestone (FGA) dont le retrait était effectué au bout de 7 ou 12 jours.

Au moment du retrait des éponges vaginales, les brebis ont reçu une administration intramusculaire de Triaprost trométhamine (0.294 mg), un analogue de synthèse des PGF2α et de PMSG (400 IU). Au cours de la saison sexuelle, les pourcentages moyens de brebis en oestrus (100%), de brebis gestantes (86.7%) et de brebis parturientes (80.0%) ont été identiques quelle que soit la durée du traitement à la progesterone. La taille moyenne de la portée n’a également pas différé en fonction de la durée du traitement (1.8 vs 1.7, traitement court vs traitement long). Au cours de la saison d’anoestrus, les pourcentages moyens de brebis en oestrus (86.6%), de brebis gestantes (76.9%) et de brebis parturientes (61.5%) obtenus après un traitement de 12 jours à la progesterone n’ont pas différé des pourcentages moyens de brebis en oestrus (93.3%), de brebis gestantes (85.7%) et de brebis parturientes (71.4%) obtenus après un traitement de 7 jours à la progesterone. La taille moyenne de la portée a été de 1.5 pour les 2 durées de traitement.

En conclusion, la durée du traitement à la progesterone utilisée dans les protocoles de synchronisation de l’oestrus peut être réduite à 7 jours sans affecter significativement les paramètres de reproduction au cours de la saison sexuelle et de l’anoestrus saisonnier.

Pregnancy rates of progestagen-synchronized ewes were lower during anestrus than during the breeding season [5]. Fertility was related positively to concentrations of progesterone during the treatment [12], probably as a result of more appropriate patterns of follicular development [12], and timing of the LH surge in relation to the onset of estrus [28]. Release of progesterone from the sponges declines over time. Therefore, a short term treatment provides higher average concentrations of progesterone during the treatment period. Such treatments (5-8 days) have shown to be effective during anestrus season [19] and breeding season [18]. Because ovulation rate and prolificacy are the lowest during the spring/summer period [8], gonadotropin treatment at the end of progesterone treatment has been used to increase prolificacy of anoestrous ewes [21].

Despite the better conception rate obtained, the efficiency of short progesterone priming for oestrous synchronization during the breeding season remains limited due to the presence of a still functional corpus luteum in some of the ewes [29].

The objective of this study was to compare the efficacy of a 7 days and a 12 days treatment with progesterone sponges in combination with PGF2α and PMSG to induce fertile estrus in both breeding and anestrus seasons in ewes.

Material and methods

ANIMALS

A total of sixty non lactating sheep, (Merinos x Akkaraman crossbred, F1) aged 18-24 months with a weight of 50-55 kg and 8 healthy rams (Merino) aged 2-3 years weighing 60-65 kg with a known fertility were used in this experiment. This study was carried out 80 to 100 days postpartum during the breeding season, i.e., between September 1-30 and during the anestrus season, i.e. between May 11-31 for ewes in Konya, Turkey. During the anestrus period, the proportion of ewes having spontaneous cycling activity (plasma progesterone levels greater than 0.5 ng/ml) was 13.33% (data not shown).

The animals were kept indoors at night and had access to natural postures outdoors most of the day. Indoors ewes were offered diets of barley, wheat bran, and wheat straw supplemented with vitamins. Water and mineral licks were available ad libitum.

METHOD

The experiment was performed at two periods, during the breeding and the anestrus seasons on 2 different groups of 30 ewes. During each period, the ewes were randomly allocated to 2 groups of 15 ewes which received short term or long term progesterone treatments, respectively. During the breeding season, a vaginal sponge containing 30 mg fluorogestone acetate (FGA, chronogest, grey sponges, Intervet-Turkey) was inserted into the vagina of the ewes for 12 days in the BLT group (n=15, long-term progesterone treatment during the breeding season) and for 7 days in the BST group (n=15, short-term progesterone treatment during the breeding season). During the anestrus season, the same protocol was applied for a period of 12 days to the OLT group (n=15, long-term progesterone treatment during the anestrus season) and for a period of 7 days to the OST group (n=15, short-term progesterone treatment during the anestrus season). At the time of sponges withdrawal, all ewes received both an intramuscular administration of Triaprost tromethamine (0.294 mg, Iliren, Intervet, Turkey), an analogue of PGF2α, and of PMSG (400 IU Folligon, Intervet, Turkey).

After the PMSG administrations, the estrus cycle of each sheep was checked twice at a 12-hour interval (630 am and 1830 pm) using teaser rams for 6 days. After the detection of estrus, sheep were hand-mated. Pregnancy was determined using ultrasonography with a transrectal probe 30 days after mating. The number of multiple embryo of each sheep was determined using the transrectal ultrasonography on day 30 and 36 as described by SCHRICK and INSKEEP [22].

The following traits were evaluated in each group.

Estrus rate: (number of ewes showing estrus behavior/treated ewes)x100.
Pregnancy rate: (number of pregnant ewes / number of mated ewes)x100.
Lambing rate: (number of lambing ewes/ number of mated ewes) x100.
Litter size: the number of total lambs/the number of lambing ewes

Data were analyzed with chi-square analysis to compare the estrus, pregnancy and lambing rates among the groups and a t-test was performed to compare the mean time of occurrence of estrus after sponge removal.

Results

Mean (± SEM) sponges withdrawal-estrus interval was 44.5±1.8 h, 42.9±1.3 h, 46.3±1.8 h and 45.6±1.50 hr in the BLT, BST, OLT and OST groups, respectively (Table I). During the breeding season, mean estrus, pregnancy, lambing rates and litter sizes were 100%, 86.7%, 80% and 1.7 in the BLT group and 100% 86.66%, 80% and 1.8 in the BST group, respectively. There were no statistically significant differences (p>0.05) between the BLT and BST groups for theses reproductive parameters.

During the anestrus season, mean estrus, pregnancy, lambing rates and litter size were 86.6%, 76.9%, 61.5% and 1.5 in the group OLT and 93.3%, 85.7%, 71.4% and 1.5 in the group OST, respectively. There were no statistically significant differences (p>0.05) between the groups OLT and OST for the reproductive parameters.

Discussion

Although the current methods of oestrus synchronization are very effective, they are applied over a relatively long period of time. However, it is possible to reduce the duration of treatment by combining progestagen with PMSG and PGF treatments [3]. Results obtained in our study indicate that a
short term FGA treatment has an efficacy comparable to that of a long-term FGA treatment during both the breeding and the anestrus seasons. The estrus response to short-term FGA treatment is comparable to that previously reported by others [2, 3, 6, 14, 18].

In our study, we have shown that the use of progesterone sponge in combination with PMSG and PGF$_2\alpha$ induced an interval between sponge removal and the onset of estrus ranging from 42.9 to 46.3 h. This time of occurrence of estrus is shorter and less variable than that reported by the former authors [2, 3, 6, 14, 18]. Injection of PGF$_2\alpha$ the day before sponge withdrawal may prevent the late occurrence of estrus resulting from spontaneous luteolysis of corpus luteum in cycling ewes.

The results obtained with the short-term treatment indicate that this method gives a high level of estrus synchronization and fertility. This result is in agreement with ÖZTÜRKLER et al. [18] who obtained a synchronization rate of 93.3% using a treatment associating short term progesterone treatment and PMSG. Furthermore, the level of synchronization produced by this treatment was similar to that obtained for the 11-days PGF regime used in other studies [18]. Moreover, the level of synchronization in both BLT and BST groups is comparable with that obtained using progestagen implant [4], progesterone sponges [2, 23, 27] and GnRH plus PGF treatment [3] during the breeding season. Improved fertility in ewes synchronized with FGA and PMSG is probably due to improved sperm transport [9], synchrony of onset of estrus and LH surge [28], or patterns of follicular development [12].

Response to FGA combined with PMSG in ewes during anestrus is similar to that obtained with injectable progestagen [1], progesterone impregnated pessaries and controlled internal drug devices combined with PMSG [6] or controlled internal drug devices combined with FSH [14].

The conception rate of progesterone-treated ewes was comparable to that previously observed during the breeding [2, 18] and the anestrus seasons [13, 16, 30]. Lambing rates in the BLT and BST group were 80.0%. These percentages are close to 84% reported by UÇAR et al. [26] in ewes treated with intravaginal sponges for 12-days followed by PMSG administration and higher than 60% reported by ÖZTÜRKLER et al. [18] in ewes treated with intravaginal sponges for 5 days followed by PMSG injection in the breeding season.

Lambing rates in the OLT and OST group were 61.5% and 71.4%, respectively. These values are (i) similar to those reported during anestrus by KNIGHTS et al. [14] in ewes treated with CIDR device for 5 days followed by FSH injection and by LALIOTIS et al. [17] in ewes treated with intravaginal sponges for 14 days followed by PMSG injection, (ii) lower than 80% reported by ZARKAWI et al. [30] in ewes treated with intravaginal sponges for 14 days followed by PGF$_2\alpha$ injection and (iii) higher than 56.1% cited by ROMANO et al. [20] in ewes treated with intravaginal sponges containing 30 mg FGA for 14 days followed by 250 IU PMSG injection during the anestrus season.

The lower fertility of ewes synchronized with progestagen-PMSG treatment during the anestrus season has been attributed to many factors such as impairment of luteinizing hormone secretion, sperm transport and fertilization [25]. Seasonal effects on reproduction of progestagen-PMSG treated ewes appear to be mediated through pituitary gonadotropin secretion with breed differences as to the time and/or intensity of seasonal effects [7].

Embryonic losses, ranging from 25 to 40%, which normally occur during early pregnancy period in domestic animals may also contribute to explain variations of pregnant and lambing rates according to treatment [10].

The mean litter size obtained in our study (1.5-1.8) was comparable with that (1.1-1.9) reported in earlier studies [15, 17, 20, 30].

This study showed that the use of short-term progesterone treatment is effective to synchronize estrus in breeding and anestrous sheep. This protocol has some advantages. The duration of synchronization procedure is shorter than that required for other method such as long-term progesterone treatments, progesterone implant or double doses of PGF$_2\alpha$. This protocol could be used as an alternative for the synchronization of estrus in sheep.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Breeding Season</th>
<th>Non-breeding Season</th>
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<tbody>
<tr>
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<td>long term</td>
<td>short term</td>
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<tr>
<td>Group</td>
<td>BLT (n=15)</td>
<td>BST (n=15)</td>
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<tr>
<td>Estrus rate (%)</td>
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<td>Conception rate (%)</td>
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<td>86.6</td>
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<td>(n=15)</td>
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<td>Lambing rate (%)</td>
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<td>(n=15)</td>
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<td>Sponge withdrawal-estrus interval (h)</td>
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<td>42.9±1.3</td>
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<tr>
<td>Litter Size</td>
<td>1.7</td>
<td>1.8</td>
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BLT : Long-term progesterone treatment during the breeding season. BST: Short-term progesterone treatment during the breeding season. OLT : Long-term progesterone treatment during the anestrus season. OST : Short-term progesterone treatment during the anestrus season.

Table I. — Mean estrus, pregnancy, lambing rates and mean litter size of each BLT, BST, OLT and OST treatment groups.
References
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