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Comparison of Different Methods of Oestrus Synchronization on Reproductive Performance of Farahani Sheep in Iran

Research Article

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ABSTRACT

This experiment was carried out on 123 Farahani ewes from a herd in Delijan city in Markazi province of Iran to determine the best short-term method for oestrus synchronization. Ewes were divided into five experimental groups randomly: group 1) use of controlled intervaginal drug release devices (CIDR) for 7 days with intramuscular (IM) injection of PGF2α on zero day and IM injection of 500 IU equine chorionic gonadotropin (eCG) at the time of CIDR removal; group 2) use of CIDR for 7 days and IM injection of PGF2α on the 6th day and IM injection of 500 IU eCG at the time of CIDR removal; group 3) use of intravaginal sponge for 7 days with IM injection of PGF2α on zero day and IM injection of 500 IU eCG at the time of sponge removal; group 4) use of intravaginal sponge for 7 days with IM injection of PGF2α on the 6th day and IM injection of 500 IU eCG at the time of sponge removal and group 5) control, without any treatment. Results showed that parturition percentage on expected date was almost doubled in all treatment groups when compared to control group. Each treatment used for oestrus synchronization increased the percentage of twinning on expected date in comparison with control group. Obtained results indicated that the most ewes lambed on expected date after 7 day treatment with both the intra-vaginal sponge and CIDR, and had a favorable impact on fertility of ewes.

KEY WORDS CIDR, Farahani sheep, oestrus synchronization, PGF2α, short-term method.

INTRODUCTION

Oestrus synchronization is one of the ways for improvement of sheep reproduction management. In fact, use of oestrus synchronization resulted in lower disturbance of pastures by sheep, better planning of controlled mating and improving of breeding approaches, production of lambs of the same age and finally accessing the sheep meat in the months when its production faced to limitation (Godfrey *et al.* 1997; Niasari-Naslaji and Soukhtezari, 2005). There are two basic methods which could be applied in oestrus synchronization. The first one is based on the application of synthetic or natural progesterone to support natural corpus luteum (CL) or imitate the luteal phase of the oestrous cycle. The second method is based on the application of synthetic prostaglandin (F2α) to remove corpus luteum. Hence, the second method is depending on the presence of CL, it is used just in breeding season, whereas the first one can be used in all over the year (Wildeus, 1999; Safdarian, 2005). Usually, gonadotropins are used mostly at the intra-vaginal device withdrawal in the process of oestrus synchronization in ewes and goats. One of the most common gonadotropin is equine chorionic gonadotropin, pregnant mare serum gonadotropin (eCG, PMSG) (Barrett *et al.* 2001). It can be seen that in some breeds of sheep, application of eCG led to light induction of super-ovulation in ewes (when used in high doses of 1000 IU; Maraček *et al.* 2009) and could increase the rate of prolificacy in ewes with low prolificacy,

desirably (Gordon, 1975). Regarding the decrease of fertility in ewes treated with progesterone for a long time (>12 days) due to vaginal infections, shortening this period (5-7 days) could decrease infection and vaginal disorders as well as facilitate management (Fonseca *et al.* 2005). Also, some authors indicated that short time application of progesterone in goats and ewes, out of breeding season, improved gestation rate rather than the long time application (Sadeghipanah, 2005; Fonseca *et al.* 2005).

It seems that depleting hormones of corpus luteum are essential for prediction of acceptable oestrus in short-time treatment in breeding season (Godfrey *et al.* 1997). Thus, PGF2α injection is applied at the end of short-time (5-7 days) progestin treatment. It is indicated that PGF2α injection at the end of short-time treatment led to diversity in oestrus cycle process due to differences in the presence or absence of CL on the ovaries of sheep and required time for increasing the progesterone to optimum level in the blood which finally affected the fertility rate after artificial insemination. In case when depletion of CL occurred at the beginning of treatment, the level of progesterone would be similar and appropriate in all ewes. Injection of PGF2α in sponging time in modified time was not applied in artificial insemination in ewes, whereas it was successful in goats (Lida *et al*. 2004; Menchaca and Rubianes, 2004).

Sadeghipanah *et al.* (2005) studied the effect of progesterone treatment duration and levels of eCG on fertility of Mehraban ewes in breeding season. Ewes treated with progesterone for 7 days and 600 IU of eCG increased fertility rate significantly rather than 12 day treatment.

Effect of CIDR and intravaginal sponge on oestrus synchronization during the long time period (12-14 days) in ewes is well documented, but use of short times requires more studies. Regarding that progesterone treatment for the long time (>12 days) may lead to decreased fertility, shortening this time to 5-7 days reduces vaginal health risk and makes the reproduction management easier. This experiment was performed to study the effect of short time method of oestrus synchronization using CIDR and / or intravaginal sponge treatment with the injection of eCG at the time of their removal and different times of PGF2α injection on fertility, fecundity and prolificacy of Farahani ewes.

MATERIALS AND METHODS

The experiment was carried out on 123 Farahani ewes in Robat Tork village, Delijan City, Iran. Ewes were fed on natural pastures. The experiment was performed from September to October, regarding the climate changes of experimental site. Ewes were divided into 5 groups based on their age and body condition scores (BCS), randomly with mean weight of 40.96 ± 0.29 kg. The treatments for experimental groups were as follows:

Group 1: use of CIDR (containing 40 mg of flugestone acetate) for 7 days with IM injection of PGF2α (Enzaprost, Ceva Santeanimale, England) on zero day and IM injection of 500 IU eCG (Pregnecol, Bioniche, Australia) at the time of CIDR removal; group 2: use of CIDR for 7 days and IM injection of PGF2α on the 6th day and IM injection of 500 IU eCG at the time of CIDR removal; group 3: use of intravaginal sponge for 7 days with I.M. injection of PGF2α on zero day and IM injection of 500 IU eCG at the time of sponge removal; Group 4: Use of intravaginal sponge for 7 days with IM injection of PGF2α on the 6th day and IM injection of 500 IU eCG at the time of sponge removal and group 5: control, without any treatment. In each synchronized group, dose of PGF2α was 15 mg and eCG 500 IU. The time of PGF2α injection, CIDR and sponge application were similar for all groups. After CIDR and sponge withdrawal, the rams were released in the ewe flock. After performing experimental treatment, the ewes went back to their flock and fed naturally on pastures and farm residues. After 5 months of gestation percentage of fertility, fecundity, twinning on expected time, and weight of lambs a birth time were recorded using following equations (1, 2 and 3).

The collected data were analyzed using SAS (2009). A randomized complete design was used for statistical analysis of Lamb birth weight and chi-square test f was used or the other traits.

1- % prolificacy on expected date= (number of lambs born/number of labored ewes) × 100

2- % fertility on expected date= (number of labored ewes/number of mated ewes) × 100

3- % fecundity on expected date= (number of lambs born/number of mated ewes) × 100

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The highest percentage of fertility was seen in the group 4 (intravaginal sponge for 7 days with IM injection of PGF2α on the 6th day and IM injection of 500 IU eCG at the time of sponge removal) and the lowest in the control group (Table 1). In all treated groups (1-4), the percentage of twinning enhanced by 8-12% compared to the control ($P<0.05$), but there was no significant difference among hormonally treated groups (Table 2).

The results indicated that the percentage of lambing (fecundity) increased in groups 1-4 in comparison with the control group on expected time ($P<0.01$) but there was no significant difference among hormone treatments. Application of hormones had no significant effect on the weight of lambs on birthday (Table 2).

Table 1 Percentage of parturition of Farahani ewes (fertility) treated for oestrus synchronization applying various methods and not treated at all (control)

Group	n	Parturition on expected date (%)	Parturition in 15-20 days from expected date (%)
1	23	86.95[a]	13.05[b]
2	23	86.95[a]	13.05[b]
3	27	85.18[a]	14.82[b]
4	25	92.0[a]	8.0[b]
5	25	48.0[b]	44.0[a]

n: number of ewes.
The means within the same column with at least one common letter, do not have significant difference (P>0.01).
Group 1: use of CIDR for 7 days with IM injection of PGF2α on zero day and IM injection of eCG on the 7th day; Group 2: use of CIDR for 7 days with IM injection of PGF2α on the 6th day and IM injection of eCG on the 7th day; Group3: use of intravaginal sponge for 7 days with IM injection of PGF2α on zero day and IM injection of eCG on the 7th day; Group 4: use of intravaginal sponge for 7 days with IM injection of PGF2α on the 6th day and IM injection of eCG on the 7th day and Group 5: without any treatment.

Table 2 Reproductive parameters of Farahani ewes treated for oestrus synchronization applying various methods and not treated at all (control)

Group	n	Twinning on the expected date (%)	Twinning in the whole group (%)	Lambing in the expected date (%)	Number of born lambs per parturition	Lamb birth weight ± SE
1	23	10[a]	8.69[a]	95.65[a]	1.1[a]	3.84±0.56[a]
2	23	10[a]	8.69[a]	95.65[a]	1.1[a]	3.66±0.36[a]
3	27	13[a]	11[a]	96.29[a]	1.13[a]	3.65±0.51[a]
4	25	13[a]	12[a]	104[a]	1.13[a]	3.78±0.58[a]
5	25	0[b]	0[b]	48[b]	1[a]	3.93±0.23[a]

n: number of ewes.
SE: standard error.
The means within the same column with at least one common letter, do not have significant difference (P>0.01).
Group 1: use of CIDR for 7 days with IM injection of PGF2α on zero day and IM injection of eCG on the 7th day; Group 2: use of CIDR for 7 days with IM injection of PGF2α on the 6th day and IM injection of eCG on the 7th day; Group3: use of intravaginal sponge for 7 days with IM injection of PGF2α on zero day and IM injection of eCG on the 7th day; Group 4: use of intravaginal sponge for 7 days with IM injection of PGF2α on the 6th day and IM injection of eCG on the 7th day and Group 5: without any treatment.

As shown in Table 3, application of treatments in groups 1 to 4 increased the number of lambing in trial ewes on expected date (P<0.01), however there was no difference among hormone treatments. Treatment for oestrus synchronization in groups 1-4 positively affected the number of twin parturition (P<0.05).

Table 4 shows the comparison of each experimental group with the control one. Number of parturition (fertility; P<0.05) and born lambs (fecundity; P<0.01) on expected date were higher for each of experimental groups than the control.

As shown in Table 1, application of CIDR and sponge doubled the number of parturition in a range of one week on expected times. These results indicated that the time of parturition was insignificantly different among time treatments; however it was higher in ewes treated with sponge for 7 days with the injection of PGF2α on the 6th day and eCG at the sponge removal compared with the control. All treatments increased fertility of ewes. Considering some methods of estrous synchronization in Kaboodeh ewes, Safdarian (2005) reported that percentage of parturition after intra-vaginal-sponge application was higher than application of CIDR. Also, number of parturition on expected time was recorded during 15 days and the aim of synchronization was estimated. Application of CIDR for oestrus synchronization caused that 74% of parturitions occurred within 6 days and 20%, 16 days after first parturition (Waldrona *et al*. 1999).

Results of Nuti *et al.* (1992) showed no differences in response and duration of estrous in dairy goats received cloprostenol (an analogue of PGF2α) on days 6 and 12 that is in agreement with our study.

There was no difference among lamb birth weights of different groups. It seemed that application of methods used in this study for oestrus and parturition synchronization had no effect on weight of lambs at the date of birth. These results were similar to Khaldari *et al.* (2005) who investigated CIDR for oestrus synchronization in Zandi ewes for 13 days followed by the application of 400 IU eCG injected to free grazing ewes. The use of above methods with application of eCG for oestrus synchronization enhanced twinning in all treated groups compared with control. Twinning in Farahani ewes was similar to the study of Niasari and Sokhteh Zari (2005).

In the present study application of CIDR or intravaginal sponge led to lambing in the range of 95-104% during one week. These results were very similar to the observations of Greyling *et al.* (1997) and Niasari and Sookhtehzari (2005) after using the same intravaginal devices for oestrus synchronization in ewes in the breeding season, but applied for 12 to 14 days. Fonseca *et al.* (2005) studied effect of duration of treatment using intravaginal sponge containing medroxyprogesterone acetate for 6 and 9 days for oestrus synchronization in non-lactating Tagn Borg goats. Their results showed that both of the 6 and 9 day treatments were the same in oestrus synchronization process (84 and 89%).

Table 3 Comparison of some reproductive traits of synchronized ewes (n=86) and control group (n=25) using χ^2 test

Item	Control group	Experimental groups
Number of parturitions on expected date	12	86
Number of parturitions after expected date	13	12
The value of χ^2 (df=1)	19.44**	
Number of single parturitions	25	88
Number of twin parturitions	0	10
The value of χ^2 (df=1)	2.77*	
Number of born lambs on expected date	12	95
Number of born lambs after expected date	13	13
The value of χ^2 (df=1)	20.61*	

* (P<0.05) and ** (P<0.01).
The means within the same column with at least one common letter, do not have significant difference (P>0.01).
Group 1: use of CIDR for 7 days with IM injection of PGF2α on zero day and IM injection of eCG on the 7th day; Group 2: use of CIDR for 7 days with IM injection of PGF2α on the 6th day and IM injection of eCG on the 7th day; Group3: use of intravaginal sponge for 7 days with IM injection of PGF2α on zero day and IM injection of eCG on the 7th day; Group 4: use of intravaginal sponge for 7 days with IM injection of PGF2α on the 6th day and IM injection of eCG on the 7th day and Group 5: without any treatment.

Table 4 Comparison of some reproductive traits of each of different synchronization method group of ewes and control group using χ^2 test

Item	Control group	Group 1	Control group	Group 2	Control group	Group 3	Control group	Group 4
Number of parturitions on expected date	12	20	12	20	12	23	12	23
Number of parturitions after expected date	13	3	13	3	13	4	13	2
Number of ewes	25	23	25	23	25	27	25	25
The value of χ^2 (df=1)	8.181**		8.181**		8.157**		11.524**	
Number of single parturitions	25	21	25	21	25	24	25	22
Number of twin parturitions	0	2	0	2	0	3	0	3
Number of ewes	25	23	25	23	25	27	25	25
The value of χ^2 (df=1)	2.268*		2.268*		2.948*		3.191*	
Number of born lambs on expected date	12	21	12	22	12	26	12	26
Number of born lambs after expected date	13	4	13	3	13	4	13	2
Number of ewes	25	23	25	23	25	27	25	25
The value of χ^2 (df=1)	7.219**		9.191**		9.547**		13.097**	

* (P<0.05) and ** (P<0.01).
The means within the same column with at least one common letter, do not have significant difference (P>0.01).
Group 1: use of CIDR for 7 days with IM injection of PGF2α on zero day and IM injection of eCG on the 7th day; Group 2: use of CIDR for 7 days with IM injection of PGF2α on the 6th day and IM injection of eCG on the 7th day; Group3: use of intravaginal sponge for 7 days with IM injection of PGF2α on zero day and IM injection of eCG on the 7th day; Group 4: use of intravaginal sponge for 7 days with IM injection of PGF2α on the 6th day and IM injection of eCG on the 7th day and Group 5: without any treatment.

It seems that as long as progesterone treatment used in lower duration, the fertility increased in goats. Safdarian (2005) reported the percent of lambing in expected time 144 and 141% after treatment with SIDR and Sponge for 12 days and injection of 500 UI PMSG in oestrus season, however there was no significant difference between them. Bitaraf *et al.* (2007) reported that application of CIDR or, flugestone acetate sponges with cloprostenol for oestrus synchronization in Nadooshani goats in the breeding season made no differences in the rate of gestation, fertility or fecundity. In the present study, the number of born lambs per parturition on expected date (prolificacy rate) was similar to the control and lower than it was reported by Safdarian (2005).

CONCLUSION

The overall results of this study indicated that application of hormones for oestrus synchronization in breeding season of Farahani ewes led to parturition in shorter time. The time of injection of PGF2α had no significant effect on reproductive traits of ewes. Also, application of eCG at sponge or CIDR removal increased the twinning rate and fecundity of ewes, so that most of parturitions occurred within one week. These results emphasized that the intra-vaginal sponge and CIDR in the short-term treatment had a favorable impact on both the fertility and fecundity rates of Farahani ewes.

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