IJAS Iranian Journal of Applied Animal Science

The Effects of Short and Long Term Medroxy Progesterone Acetate (MAP) Sponge Treatments on Reproductive Performance during the Non-Breeding Season of Arabian Ewes

Research Article

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Received on: 7 Dec 2013
Revised on: 5 Feb 2014
Accepted on: 15 Feb 2014
Online Published on: Dec 2014

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Online version is available on: www.ijas.ir

ABSTRACT

The aim of this study was to evaluate the reproductive efficiency of short and long term treatment with progestagens in addition to pregnant mare serum gonadotropin (PMSG) in Arabian ewes during the non-breeding season. A total of 56 ewes were divided into three groups: in group I vaginal sponges (60 mg medroxy progesterone acetate; MAP) were applied and removed after 6 days; in group II, vaginal MAP sponges were removed 14 days following insertion while group III served as control group. The first two groups were intramuscularly injected with of 600 IU PMSG, following sponge removal. Parameters such as estrus response rate, duration of estrus, pregnancy rate and fecundity were evaluated. There were no significant differences in estrus response rate and fecundity rate between groups I and II ($P>0.05$). However, differences were significant when these two treatment groups were coMAPred with control group. In group I, duration of estrus was significantly higher than group II ($P<0.05$). In addition, pregnancy rate in group I was significantly higher than group II ($P<0.05$). It was concluded that short-term sponge treatment (6 days) had better performance when coMAPred with long-term sponge treatment (14 days) in Arabian ewes.

KEY WORDS Arabic ewes, MAP sponge, non-breeding season, reproductive performance.

INTRODUCTION

Estrus synchronization is a valuable management tool that has been successfully employed to enhance reproductive efficiency, particularly in ruminants (Hashemi *et al.* 2006), and can improve sheep production systems by nutritional and / or hormonal treatments resulting in higher estrus responses and subsequent conception rates (Kridli *et al.* 2003). Progestagens or its analogs along with gonadotrophin have been used to induce estrus in anestrus ewes, although pregnancy rates of progestagen-synchronized ewes are lower during anestrus than during the breeding season. Progestins can be administered by daily injections as a feed additive or intravaginal devices (CIDR or Sponge) (Ozyurtlu *et al.* 2011). The general hormonal technique for estrus synchronization in ewes is the use of intravaginal devices impregnated with progesterone or synthetic progestagen such as fluorogestone acetate (FGA) or medroxy progesterone acetate (MAP) (Karaca *et al.* 2009). Intravaginal sponges impregnated with progestagen have been widely used in sheep during the breeding and non-breeding seasons (Romano, 2004). The impregnated sponges with progestagens are more effective than natural progesterone at lower dose levels (Ozyurtlu *et al.* 2011). A precise estrus synchronization has been documented using intravaginal sponges impregnated with progesterone, followed by an

administration of pregnant mare serum gonadotropin (PMSG) (Camacho *et al*. 2008). Intravaginal sponges are usually inserted over periods of 6-14 days and an injection of PMSG is administered prior or at time of sponge removal (Wildeus, 2000; Ustuner *et al.* 2007). PMSG or equine chorionic gonadotropin (eCG) is used for induction of ovulation and estrus outside the breeding season, and such treatment is more effective for synchronization during the breeding season. In addition, eCG has been found to increase ovulation rate and twinning in a dose-related manner (Gungor *et al*. 2009). Some studies considered that the use of synthetic progesterone accelerated the mechanism of follicular growth and development (Kridli and Al-Khetib, 2006). Along with that, some studies on shorten periods of progesterone treatments have shown increases on fertility as well as reduced chances of vaginal discharge and contamination which would favor management greatly (Fonseca *et al*. 2005; Amer and Hazzaa, 2009). Fonseca *et al*. (2005) studied the effects of treatment duration (6 and 9 days) with intravaginal sponges containing 60 mg MAP for estrus synchronization in non-lactating Toggenburg goats. Both treatments were equally effective in inducing estrus (6 days=84% and 9 days=89%). Long-term progestagen treatments effectively synchronized estrus, although with variable fertility rate (Menchaca and Rubianes, 2004). For the last 15 years, an alternative method for estrus synchronization in small ruminants named short-term progestagen treatment (5-7 days progestogen priming) has been developed (Metodiev and Raicheva, 2011). Short-term MAP priming before introducing rams may be used with results similar to those achieved by traditional long-term priming (Ungerfeld *et al*. 2003). The aim of this study was to coMAPre the efficacy of co-administration of long-term and short-term progestagen (MAP sponge) with PMSG prior to ram introduction on estrus response rate, duration of estrus, pregnancy rate and fecundity of Arabian ewes in the non breeding season.

MATERIALS AND METHODS

This study was conducted during the non-breeding season (April-August) at the research farm of Ramin Agriculture and Natural Resources University in the Ahwaz province, southern Iran. Fifty six Arabic ewes 2-5 years old with mean weight of 45 kg were used in this study. The animals had access to natural grazing area for most of the day, while indoor a diet (0.5 kg/day) of barely seed, Alpha Alpha, corn silage and wheat straw feed was administered. Water and mineral licks were available ad libitum. The ewes were randomly assigned to 3 groups; (I) intravaginal sponge containing 60 mg medroxy progesterone acetate (MAP) for 6 days (n=15), (II) intravaginal sponge containing 60 mg medroxy progesterone acetate (MAP) for 14 days (n=22) and (III) control group (without hormonal treatment) (n=19). Immediately after sponge removal, 600 IU of PMSG (Nasr Pharma CoMAPny) was intramuscularly injected to the treated ewes. Then, the ewes were placed in pens and one healthy ram was introduced for every 5 ewes, in order to detect heat and mating. Estrus signs were detected and recorded every hour for 5 days. The percentages of ewes that showed overt signs of estrus during a period of five days (estrus response), duration of estrus and pregnancy rate (number of pregnant ewes/total number of ewes×100) were recorded (Ozyurtlu *et al*. 2011). Fecundity rate was calculated based on the number of lambs born (Kridli *et al*. 2006).

Statistical analysis

Data were analyzed using SAS (1996). Estrus responses and pregnancy rate were analyzed by chi-square test. Estrus duration and fecundity rate were evaluated by general linear model (GLM) procedure of SAS. The Duncan test was used to analyze the differences of estrus expression and, duration, pregnancy and fecundity means between short and long terms of MAP sponge treatments. The level of significance was set at 5%.

RESULTS AND DISCUSSION

The effect of short and long term application of MAP sponge on estrus response, duration of estrus, pregnancy and fecundity rates in Arabian ewes are shown in Table 1.

Table 1 Effects of short and long-term medroxy progesterone acetate (MAP) sponge treatment on estrus performance, pregnancy and fecundity rates in Arabian ewes during non-breeding season

Variable / treatments (Mean±SE)	T1 (short term MAP) n= 15	T2 (long term MAP) n= 22	T3 (control) n= 19
Response of estrus (%)	93.33±1.03 (14/15)^{a}	91±0.74 (20/22)^{a}	5.26±1.02 (1/19)^{b}
Pregnancy rate (%)	80.0±0.64 (12/15)^{a}	54.55±0.42 (12/22)^{b}	0^{c}
Fecundity rate (%)	57±0.54 (8/14)^{a}	50±0.44 (10/20)^{a}	-
Estrus duration (h)	26.10±1.33^{a}	14.77±1.11^{b}	-

The means within the same row with at least one common letter, do not have significant difference (P>0.05).
SE: standard error.

The highest pregnancy rate was observed in ewes that received MAP sponge for 6 days (Short-term) when coMAPred to ewes that received sponges for 14 days as well as to the control group (P≤0.05). This study shows that short term sponge treatment results in higher duration of estrus when coMAPred to the other two groups (Table 1) (P≤0.05). There were no significant differences in estrus response and fecundity rates between the two experimental groups (P>0.05).

Increasing rate of fecundity in sheep offers the best opportunity to increase the efficiency of lamb meat production (Turk *et al.* 2008). In this study, an injection of 600 IU PMSG was used in order to induce follicular growth and increase pregnancy rate. The injection of PMSG at the time of estrus and prior mating, causes a higher pregnancy rates during the non-breeding season (Turk *et al.* 2008). Zarkawi *et al.* (2009) reported a higher lambing rate (80%) in Awassi ewes outside the breeding season, when 600 IU of PMSG were administered following MAP removal, coMAPred to ewes in the control group. Short-term progestagen treatment showed higher progesterone levels at the time of device withdrawal, and in addition this procedure can be considered a good alternative to traditional procedures, due to its flexibility under field conditions. Furthermore, this protocol enhances fertility due to a higher progesterone level induced by the short term sponge insertion. In fact, it has been shown that low levels of progestagen reduce subsequent fertility, and there are two possible explanations for this reduction of fertility, such as iMAPired sperm transport and an extension of the lifespan of the ovulatory follicle (Ozyurtlu *et al.* 2011). It has been reported that anestrus ewes receiving sponges for 6 days, may show estrus after ram introduction (Knights *et al.* 2001). It is known that prolonged progesterone treatment has an adverse effect on oocyte development. Long-term progestagen treatment results in subluteal progesterone level and this leads to an increase in LH pulse frequency, although luteinizing hormone (LH) surge does not occur and results in persistence of the largest follicle (Vinoles *et al.* 1999; Menchaca and Rubianes, 2004; Ozyurtlu *et al.* 2011).

Ungerfeld and Rubianes (2002) showed that short-term progestagen treatment was sufficient to induce estrus and that no difference in estrus response was observed when anestrus ewes were primed for either 6 or 14 days, with intravaginal sponge treatment. These results are in agreement with the findings of this study. Ustuner *et al.* (2007) reported 77.1% and 88.2% estrus induction following short-term and long-term sponge treatments, respectively, in Awassi ewes. No significant difference was observed in estrus response rate between groups. Estrus response rate reported in the present experiment is higher when coMAPred to a similar study by Ustuner *et al.* (2007). This difference is probably due to breed difference in response to the treatment protocol (Bulent Bulbul *et al.* 2006).

In this study, estrus was observed mostly between 36 to 60 hours after sponge removal (Figure 1). Estrus duration in the short-term (26.10 h) group was higher than the long-term treatment (14.77 h) (P≤0.05).

The duration of estrus as reported by Nasser *et al.* (2012) was 34.4 and 36.7 hours following a short (6 days) and a long (12 days) term controlled internal drug release (CIDR) treatment,, respectively during the breeding season, and this is consistent with the results obtained by Ustuner *et al.* (2007). In another study by Dogan (2006), MAP \ PGF2α treatment gave shorter estrus duration coMAPred to MAP treatment alone.

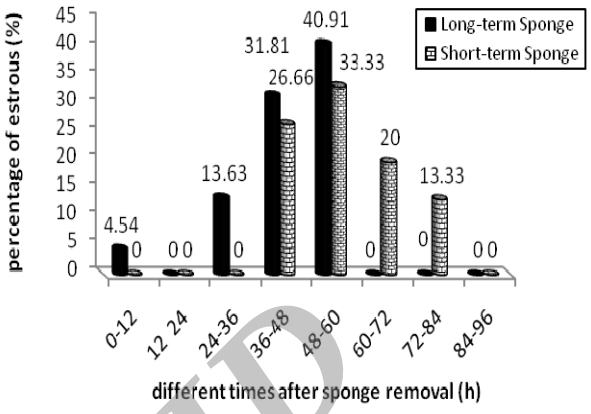

Figure 1 Estrus incidence times after sponge removal in non-breeding season of Arabian ewes

Short duration of estrus in the present study may be attributed to lower estrogen level in the blood, breed differences, age and geographical location. Stimulation of follicular growth in the ovary by follicle-stimulating hormone (FSH) or exogenous eCG together with high levels and longer duration of serum estrogen concentrations, could be responsible for a prolonged duration of the estrus period (Nasser *et al.* 2012). In this study, ewes that did not display estrus behavior during 35 days from mating (after second estrus period) were considered as pregnant ewes (Moghaddam *et al.* 2012). In the present study, pregnancy rate was significantly higher in short-term group (80%) than long-term group (54.55%) (P≤0.05). This is in agreement with the study by Vinoles *et al.* (2001), where higher pregnancy rate after short-term treatment coMAPred to the traditional (12 d) treatment with PMSG at the time of vaginal sponge withdrawal, was obtained. Ungerfeld and Rubianes (2002) recorded 66.7% and 58.3% pregnancy rates in short-term and long-term treatments, respectively. Differences in pregnancy rate can be ascribed to differences in mating systems, breed, season, duration of treatment and overall managerial conditions (Safdarian *et al.* 2006). Dogan and Nur (2006) obtained 76.5% pregnancy rate with AI at a fixed time after the use of the MAP-PMSG protocol during non breeding season in Kivircik ewes. Morris *et al.* (2004) achieved poor pregnancy rates (36-55%) even with the use of progesterone primed controlled internal drug release (CIDR) and equine chorionic gonadotropine (eCG). In a study by Ataman *et al.* (2006), progesterone treatment for 7 days was effective to synchronize estrus in sheep during both breeding and non-breeding seasons. These results

are consistent with the findings presented in this study, where a better performance has been recorded following a short-term protocol of sponge insertion. Nosrati *et al.* (2011) indicated that PMSG is a beneficial adjunct to the breeding of sheep by artificial insemination (AI) at progestagens-synchronized estrus, and administration of 600 IU PMSG after CIDR withdrawal is more effective for increasing the reproductive performance of artificially inseminated Kurdi ewes during the breeding season.

CONCLUSION

In conclusion, the results presented in this study give evidence that a short-term progestagen protocol prolongs estrus duration and increase pregnancy rate, when coMAPred to a long-term treatment. Rate of estrus and fertility following treatment were not affected by length of MAP insertion. Thus, short-term progestagen treatment procedure (6 days) for induction of estrus can be a good alternative to traditional procedures (12-14 days), leading to higher performance in farm condition.

ACKNOWLEDGEMENT

The authors gratefully acknowledge the Ramin Agriculture and Natural Resources University for research funds and Graduate CoMAPny of Khorramabad Animal Science for MAP sponge preparation.

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