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Effects of PMSG Doses on Reproductive Performance of Kurdi Ewes Artificially Inseminated during Breeding Season

Research Article

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ABSTRACT

This experiment was conducted to determine the reproductive performance of Kurdi ewes which were artificially inseminated (AI). In total 240 Kurdi ewes, weighing 49.5±2.5 kg were used in the trail. The ewes were allocated randomly to one of four groups (n=60/in each group). For synchronizing, controlled internal drug release (CIDR) was placed in the vagina of all individuals for 14 days. After removing the CIDR, pregnant mare's serum gonadotropin (PMSG) hormone was intramuscularly injected at the dosages of 300, 400, 500 and 600 IU in four groups of ewes. Cervical artificial insemination was performed after two days following CIDR withdrawal and hormone administration. The conception rates in groups I, II, III and IV were found as 63.7, 66.1, 65.8 and 67.9%, respectively. The mean litter size was significantly higher in groups II, III and IV (1.30, 1.34 and 1.46) than group I (1.11). The fecundity rate was lowest in group I (65.6%). Administration of 600 I.U PMSG resulted in the highest (58.9%) multiple births ($P<0.05$). These results suggest that 600 I.U. PMSG was more effective in increasing multiple births in the Kurdi ewes in breeding season.

KEY WORDS estrus synchronization, Kurdi sheep, PMSG dosage, reproductive performance.

INTRODUCTION

Iran is one of the major domestication areas for ovine and bovine species (Mazlum, 1971). Currently there are 26 native sheep breeds, mainly fat-tailed, 8 native goat breeds and also 9 bovine breeds including *Bos taurus* and *Bos indicus* (Scherf, 2000). Kurdi sheep is a native Iranian meat type sheep breed in North Khorasan province (Nassiry *et al.* 2007) that is located in 37º46'N and 57º33'E. According to official report of the Ministry of Agriculture, mean lambing rate in Khorasan province is 0.7 lambs per ewe/year (Fallah Rad and Farzaneh, 2007). One of the main reasons for low prolificacy is weak reproductive management in this flock. To have a better reproduction efficiency, it has been suggested to use new reproductive approaches such as controlling and synchronizing of estrus and using PMSG by applied AI to increase prolificacy that leads to gain practical and economical advantages (Wildeus, 1999). Recently, Progesterone or its analogues is generally used to synchronize estrous during the breeding and non-breeding season (Dogan *et al*. 2005). Administration of gonadotropins such as human menopausal gonadotropin (hMG) (Evans, 2003), PMSG (Lamrani *et al*. 2008), follicle stimulating hormones (FSH) and mixed gonadotropins preparations (Knights *et al*. 2003) after stopping progestagens treatment, causes increasing rate of ovulation. Between all endocrine approaches to increase lambing rate, administration of PMSG is more usual than others. Injection of PMSG at the end of

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the progestagens treatment causes more precise synchronization of oestrus in small ruminants (Wildeus, 1999). Ustuner *et al*. (2007) reported that injecting PMSG after CIDR removal causes oestrus signs to begin earlier, become more pronounced and prolonged. A prolonged oestrus probably results in elevation of circulating estrogen that causes luteinizing hormone (LH) peak (Yildiz *et al*. 2004). This might increase the rate of ovulation and enhances twining rate. It has been shown that an adequate dose of PMSG improves proliferation, but the use of high dose induces multiple gestations and thus, an increase in fetal or lamb mortality (Ataman *et al*. 2006). Hence, to avoid non-desirable fetal or losses and large litter sizes, the dosage level of such gonadotropin has to be adjusted according to breed, season and the physiological status of the ewes (Simonetti *et al*. 2002). Therefore, the objective of this study was to determine the influences of different PMSG doses on reproductive performance of Kurdi ewes inseminated by fresh semen.

MATERIALS AND METHODS

Animals

Totally 240 native Kurdi ewes, 2-5 years old with body weight ranges of 45-55 kg which had previously experienced at least one pregnancy were divided into four groups at the beginning of the breeding season (september). The 20 Kurdi rams between 3 to 5 years old weighing 75-85 kg have been used for this study. The experiment was performed at Kurdi Animal Breeding Station in North Khorasan province. All ewes maintained as one flock under field conditions. The ewes were kept indoors at night and had access to grazing outdoors for most of the day. Indoors, the ewes were fed barley grain, wheat bran and wheat straw supplemented with vitamins. Water and mineral licks were available ad-libitum.

CIDR and PMSG treatment

Ewes were randomly divided into 4 groups. All groups were implanted with CIDR-G device (containing 330 mg progesterone-New Zealand) for 14 days. At withdrawal of the CIDR on 14th day, the ewes were given intramuscularly different doses of PMSG (Folligon, Intervet, Boxmeer and Holland) as shown in table 1. Kurdi rams (n=20) whose fertility was proven in previous mating season, were utilized in the artificial insemination program. Semen was collected by means of an artificial vagina during the breeding season. The semen volume, motility and concentration were recorded for each ejaculate immediately after collection. The volume of semen was measured with a calibrated collection vial. Sperm concentration was measured by haemocytometer method (Herman and Madden, 1963).

The individual motility of sperm was observed under microscope. Then the semen was mixed with diluter (Egg-yolk-citrate), fixed the sperm concentration at 300×10^6/mL. Two days after removal of CIDR, ewes which showed oestrus, were artificially inseminated. Cervical insemination was performed on a breeding rack by lifting the hindquarters of the ewes over the top tail, while the front legs remained standing on the ground. All the ewes were inseminated with 0.25 mL of diluted fresh semen with 250-300×10^6 spermatozoa and 80% or higher motility. The semen was deposited into the external of the first cervical fold, using a speculum fitted with an internal light source. During collection and examination, the semen was protected from temperature shock and immediately transferred to the laboratory for investigating quality and quantity. Two months after the insemination, conception rate of animal in all groups were checked by transabdominal ultrasonography, using Medeta ultrasound scanner.

Table1 Treatment and estrous responses following estrous synchronization in Kurdi ewes

Teatment	PMSG(Iu)	n	Number of ewes showing oestrus	Oestrus response (100%)
I	300	60	60	100
II	400	60	60	100
III	500	60	60	100
IV	600	60	60	100

Statistical analysis

The following traits were evaluated for each group: Oestruse response: number of ewes showing oestrus/total ewes treated in each group×100 (Akoz *et al*. 2006). Conception rate: number of pregnant ewes/number of ewes showing oestrus and inseminated in each group×100 (Zeleke *et al*. 2005). Litter size: the number of lambs born/ewes lambing×100 (Avendano-Reyes *et al*. 2007). fecundity rate the number of lambs born/ewes inseminated (Langford, 1986). Multiple birth rates: number of multiple lambing/total lambing in each group×100 (Akoz *et al*. 2006).

The numbers of lamb born/ewe were recorded daily during lambing. Fertility was monitored in term of conception rate, mean litter size and fecundity rate. Data of litter size statistically analyzed by PROC GLM (SAS, 1997) and means comparisons were conducted by Tukey test, while other data were analyzed by PROC GENMOD (SAS, V. 9.0). Effect of treatments were declared significant (P<0.05).

RESULTS AND DISCUSSION

Fertility in sheep is increased by hormone application to 20-50% (Yavuzer, 2002). For example, the use of PMSG after

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progestagens treatment, increases ovarian response, conception rate and percentage of multiple births from the induced ovulations (Boscos *et al*. 2002). Oestrus response and conception rate (%), litter size, fecundity rate (%) and multiple births (%), in each subgroup of this trail are shown in Tables 1 and 2.

Multiple birth in group IV with injection dose of 600 I.U. (58.9%) was the highest value between all groups (P<0.05). This value in groups II (28.9%) and III (33.5%) were higher than group I (11.8%) (P<0.05). Some papers reported that administration of 300 IU PMSG was not sufficient to stimulate additional follicular development or was weak for some breeds response (Koyuncu *et al*. 2008; Romano, 1996). Twining rate in experiment of Özbey and Tatli (2001) that synchronized the Awassi ewes for 14 d with sponges containing 40 mg of FGA and superovulated by 500 IU of PMSG injection were 46% that is higher than the result of current study obtained by using 500 IU PMSG. Multiple birth in experiment of Akoz *et al*. (2006) synchronizing of oestrus by vaginal sponge with 40 mg FGA for 7 days in combination with 300 and 500 IU PMSG injection after removal sponge on Akkaraman cross-bred ewes in non-breeding season were 20 and 36.4%, respectively that is different from the present result in 300 I.U PMSG group. Karagiannidis *et al*. (2001) reported that responses to the different PMSG doses among various breeds were different.

For the success of an artificial insemination program using synchronization, it is necessary to have a high oestrus response. Oestrus synchronization success ranging between 85 and 100% has been obtained in other experiments performed during breeding season by progestagens treatment and PMSG in Akkaraman cross-bred ewes (Ataman *et al*. 2006; Akoz *et al*. 2006), Dorper ewes (Zeleke *et al*. 2005), Hamadani ewes (Timorkan and Yildize, 2005) and Karakul ewes (Hashemi *et al*. 2006). The percentage of ewes exhibiting oestrus in this trail was comparable to the value reported in the above literatures. All of 240 ewes used, exhibited overt signs of oestrus during 48 h observation period. No significant differences in percentage of ewes exhibiting oestrus was recorded between ewes synchronized with progestagens and different doses of PMSG (Table 1). The highest oestrus response (100%) in this experiment has been reported by Ataman *et al*. (2006) on Akkaraman cross-bred ewes.

In this experiment, there was no difference in conception rate between all groups. Various factors are effective in conception rate, such as nutrition before and under mating season, mating system, age, natural or artificial insemination, type of insemination (Simonetti *et al*. 2002), the time of PMSG administration before or after removal of sponge or CIDR (Zeleke *et al*. 2005) and PMSG dose (Wildeus, 1999). Previous studies demonstrated that conception rates vary (20-80%) after different progestagens treatment following timed AI using fresh diluted semen than natural mating (Ustuner *et al*. 2007). The conception rate in this study is comparable with the results obtained by Simonetti *et al*. (2002) in Merino ewes in 400 IU PMSG (60%). In the study of Timurkan and Yildis (2005), there was no significant difference between 500 and 600 IU PMSG group for conception rate in breeding season which is similar to the result of present study. However, the present results were lower than those obtained by Zeleke *et al*. (2005), Akoz *et al*. (2006) and Ince and Karaca (2009).

PMSG, when injected immediately after the removal of CIDR increased the rate of ovulation hence, increasing multiple births and litter size (Akoz *et al*. 2006). The mean litter size in groups II, III and IV were higher than group I (P<0.05). Similar to litter size, the fecundity rate in groups with 300 IU PMSG administration was lowest (P<0.05). In this experiment with increasing in PMSG dosage the fecundity rate was increased. Ince and Karaca (2009) reported 1.33 and 1.39 litter sizes for 400 and 500 IU PMSG in Chio×Kivircik ewes which is similar to this result. In Timorkan and Yildize (2005) trail on Hamadani ewes, the lit-

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Table 2 Effect of different PMSG doses on reproductive performance of adult Kurdi ewes*

Parameter	Treatment			
	I	II	III	IV
Conception rate (%)	63.7±0.24[a]	66.1±0.23[a]	65.8±0.27[a]	67.9±0.22[a]
litter size	1.11±0.07[a]	1.30±0.09[b]	1.34±0.07[b]	1.46±0.09[b]
Fecundity rate (%)	65.6±0.39[a]	94.4±0.36[b]	99.5±0.38[b]	126.2±0.41[b]
Multiple births (%)	11.8±0.48[a]	28.9±0.49[b]	33.5±0.53[b]	58.9±0.52[c]

*The means in each row that have at least one common letter, do not have significant difference (P>0.05).

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ter size was 1.06 and 1.25 for groups that were treated with 300 and 400 IU PMSG, respectively. Their results were lower compared to present study. Also, there are number of experiments which reported a higher level of litter size than this research such as Simonetti *et al*. (2002), who reported an average litter size of 1.45 in Merino ewes treated with 400 IU PMSG. The observed variation depends on various factors such as breed, age, time and dose of PMSG administration (Dogan ans Nur, 2006). Salehi *et al.* (2010) reported that the different sheep breeds have been identified as a major source of variation in the superovulatory response.

In conclusion, the findings of the present research indicate that PMSG is a beneficial adjunct to the breeding of sheep by AI at progestagens-synchronized oestrus and administration of 600 IU PMSG after CIDR withdrawal is more effective for increasing the reproductive performance of artificially inseminated Kurdi ewes in breeding season.

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