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EFFECT OF INTRAVAGINAL PROGESTERONE SPONGE AND PMSG ADMINISTRATION ON ESTRUS OCCURRENCE AND LITTER SIZE OF PRIANGAN SHEEP

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ABSTRACT

The objective of this study was to evaluate the use of intravaginal progesterone sponge followed by pregnant mare serum gonadotropin (PMSG) administration at different time of sponge withdrawal on the estrus rate and litter size of Priangan sheep. A total of 33 non-pregnant Priangan sheep were divided into four groups of treatment. Group 1 (G1) received intravaginal sponge containing 30 mg of medroxyprogesterone acetate (MPA). Group 2 (G2), 3 (G3), and 4 (G4) received intravaginal sponge containing 30 MPA and followed by intra muscularly injection of 300 IU PMSG at 24 hours before sponge withdrawal, at sponge withdrawal, and 24 hours after sponge withdrawal, respectively. The result showed that all treatment groups have 100% of estrus rate. However, the occurrence of estrus time varied among the group after intravaginal progesterone sponge withdrawal. Group 1 (G1) and G4 tend to have estrus occurrence at day three after intravaginal progesterone sponge withdrawal by 55% and 75% response, respectively. Whilst, G2 and G3 tend to have estrus occurrence respectively at day 1 (62.5%) and day 2 (50%) after intravaginal progesterone sponge withdrawal. A 100% of pregnancy rate occurs in G2 and G4, while G1 and G3 have an 88.9% and 87.5%, respectively. Litter size was significantly reduced in G4. In conclusion, the use of either progesterone alone or combined with PMSG is effective for estrus synchronisation in Priangan sheep, but the administration PMSG at one day after intravaginal progesterone sponge withdrawal reduced the litter size of Priangan sheep.

Key words: Aceh intravaginal progesterone sponge, litter size, estrus rate, PMSG, sheep

ABSTRAK

Tujuan dari penelitian ini adalah untuk mengevaluasi perbedaan waktu pencabutan spon progesterone intravagina yang di ikuti pemberian pregnant mare serum gonadotropin (PMSG) terhadap persentase estrus dan jumlah anak per kelahiran domba Priangan. Tiga puluh tiga ekor domba Priangan betina dikelompokkan kedalam empat kelompok perlakuan. Kelompok 1 (K1) adalah kelompok domba yang mendapat perlakuan spon intravagina yang mengandung 30 mg medroxyprogesterone acetate (MPA). Kelompok 2 (K2), 3 (K3), dan 4 (K4) mendapat perlakuan 30 mg MPA yang diikuti permberian 300 IU PMSG secara intramuscular secara berturut-turut pada 24 jam sebelum pencabutan spon, pada waktu pencabutan, dan 24 jam setelah pencabutan spon. Hasil penelitian menunjukkan bahwa 100 % domba pada setiap kelompok menunjukkan gejala estrus. Namun, munculnya waktu estrus setelah pencabutan spon bervariasi antar kelompok perlakuan. K1 dan K4 cenderung menunjukkan waktu estrus pada hari ketiga setelah pencabutan spon dengan respon estrus berturut-turut 55% dan 75%. Waktu estrus pada K2 dan K3 cenderung pada hari kesatu (62,5%) dan hari kedua (50%) secara berturut-turut setelah pencabutan spon. Persentase kebuntingan 100% terjadi pada K2 dan K4, sedangkan persentase kebuntingan pada K1 dan K3 secara berturut-turut sebesar 88,9% dan 87,5%. Jumlah anak per kelahiran secara signifikan mengalami penurunan pada K4. Kesimpulan, penggunaan progesterone baik sendiri maupun dikombinasikan dengan PMSG secara efektif menyerentakkan waktu estrus pada domba Priangan, namun pemberian PMSG satu hari setelah pencabutan spon progesteron intravagina menurunkan jumlah anak per kelahiran domba Priangan.

Kata kunci: spon progesterone intravagina, jumlah anak per kelahiran, persentase estrus, PMSG, domba

INTRODUCTION

Estrous synchronisation is a reproductive technique in livestock which can control the female estrus so they can be bred relatively at the same time. Through this technique pregnancy, lambing period, as well as the age of lamb could be uniformed so that the management can be easy to handle and improve the marketing of lamb products. The mentioned advantages lead to an increase of reproductive efficiency of the farms.

The use of progesterone devices is useful to synchronise the time of estrus that mimics the luteal phase of the estrus cycle. Medroxyprogesterone acetate (MAP) contained in the intravaginal sponge is an example of progesterone that has been effectively used for estrus induction in sheep. Simonetti *et al.* (2000) reported that ewes induced with MAP showed 77% to 80% of estrus occurrence and estrus onset at 55 to 57 hours after sponge withdrawal. However, intravaginal progesterone sponges have a limitation in increasing litter size. Koyuncu and Altıcekic (2010) reported that the use of progesterone in estrus induction does not increase litter size.

In principle, litter size can be increased by controlling follicle stimulating hormone (FSH) regulation in the bloodstream. Administration of pregnant mare serum gonadotropin (PMSG) can increase multiple birth rate in breeds characterised by low litter size (Boscos *et al*., 2002; Turk *et al*., 2008). The use of PMSG in combination with MAP was characterised by 114.6% of multiple births proportion (Koyuncu and Alticekic, 2010), and compact induction was found in the combination rather than in MAP alone (Dogan and Nur, 2006).

Priangan sheep is a particular breed of sheep in West Java and has prolificacy more than one. Mason (1980) reported that Priangan sheep has 1.8 of litter size which means that every ten heads of sheep give 18 lambs. Mating of Priangan sheep takes time and labour due to a less obvious event of estrus. Hence, precise detection of estrus becomes essential in this breed.

Even though reproductive performance after intravaginal sponge containing progesterone has been studied in various breeds of sheep, but the combination of GnRH with intravaginal progesterone sponge

insertion in Priangan sheep has been limited. Therefore, the objective of this study was to evaluate reproductive performance of Priangan sheep after intravaginal progesterone sponge and PMSG administration.

MATERIALS AND METHODS

In this study, 33 non-pregnant ewes were used and grouped into four different groups. Group 1 (G1) received intravaginal sponge containing 30 mg of medroxyprogesterone acetate (MPA). Group 2 (G2), 3 (G3), and 4 (G4) received intravaginal sponge containing 30 MPA and followed by 300 IU i.m. of PMSG administration at 24 hours before sponge withdrawal, at sponge withdrawal, and 24 hours after sponge withdrawal, respectively. The intravaginal sponge remained in the vagina for 14 days in all ewes. Group 1 served as control (no PMSG treatment). Estrous was determined using Draminsky'sestrus detector for sheep and was validated with the cervical dilatation described by Kershaw *et al*. (2005). In brief, an ovine inseminating pipette was passed out into the cervix. If the pipette were able to penetrate the entrance of external os of the cervix without the use of excessive force, then the female was categorised as estrus.

The estrus rate was evaluated by calculating the percentage of ewes which display estrus signs per total treated ewes. Ewes which exhibited estrus were artificially inseminated. The semen was collected from fertile rams by using an artificial vagina. All the ewes were inseminated with 0.25 ml of diluted fresh semen with 85% motility of spermatozoa utilising an insemination pipette and speculum. Two months after insemination, all ewes were checked for pregnancy rate using Draminsky's pregnancy detector.

The number lambs born per ewe were recorded daily during lambing. Estrus and pregnancy rate were descriptively analysed. Litter size was investigated using analysis of variance (ANOVA). The differences between experimental groups were evaluated using Tukey's HSD test as post-hoc multiple comparison tests. The significantly different level was considered significant at $P<0.05$.

RESULTS AND DISCUSSION

In this study, all group exhibited 100% estrus rate, but the occurrence time varied among groups (Table 1). The occurrence time of estrus was characterised by a low value of mucus resistance showed on estrus detector device and cervical dilatation. In group 1, most of the ewes showed estrus signs at day three after sponge withdrawal by 55.6%. This occurrence is longer than other groups (G2 and G3) which showed two days after PMSG administration. The progesterone concentration declined rapidly after intravaginal progesterone sponge withdrawal, followed by the increase of estrogen due to follicle start to grow. The rate of follicle growth is dependent on FSH concentration. PMSG in this regard acts as additional endogenous FSH function which supports follicle growth. This is might the reason that estrus occurrence in G1 is relatively longer than group 2 and group 3. However, PMSG administration 1 day after intravaginal progesterone sponge withdrawal (G4) might be late to support endogenous FSH. Hence, follicle growth, estrogen secretion, and estrus occurrence might be slightly delayed. This result is in accordance with Dogan and Nur (2006) who reported that estrus-induced ewes using MAP combined with PMSG showed 72.2% estrus rate at day 2 (31.1±1.8 hours) after treatment. Moreover, Husein *et al*. (1998) elucidated that onset of estrus occur faster and uniform for the group of ewes which is treated by the combination of progesterone and PMSG compared with those who received only progesterone in the intravaginal sponge. The use of PMSG is important in estrus synchronisation in sheep (Cline *et al*., 2001).

In general, the result of this study was similar to previous studies that estrus emerged at the time interval of 24-144 hours after sponge withdrawal (Rubianes *et al*., 1999; Simonetti *et al*., 2000; Dixon *et al*., 2006). In group 1 which only use intra-sponge vagina, estrus occurred at day 3 or 72 hours after sponge withdrawal, while group 2, 3, and 4, estrus tend to show at day 1, day 2, and day 3 after sponge withdrawal, respectively, or at day two after PMSG administration. It has been observed that PMSG injection is required to stimulate follicular growth, leading to a tighter synchrony of ovulation in both anestrous and cycling of sheep (Greyling and van Niekerk, 1991; Cline *et al*., 2001). This indicated that PMSG stimulates the development of follicles producing estrogen resulted by the proliferation of granulosa cells, thus leads to the sign of estrus.

In the present study, 100% of pregnancy rate was found in group 2 and group 4 (Table 2). This result is higher compared to aprevious research in ewes treated with intravaginal progesterone sponge and PMSG

Table 1. Estrus rate per day after intravaginal progesterone sponge withdrawal

Group	Estrus rate				Total
	Day 0	Day 1	Day 2	Day 3	(%)
1	0% (0/9)	11.1% (1/9)	33.3% (2/9)	55.6% (6/9)	100
2	0% (0/8)	62.5%(5/8)	12.5% (1/8)	25.0% (2/8)	100
3	0% (0/8)	12.5% (1/8)	50.0% (4/8)	37.5% (3/8)	100
4	0% (0/8)	12.5% (1/8)	12.5% (1/8)	75.0% (6/8)	100

Day 0-3= Day after intravaginal progesterone sponge withdrawal, Group 1= Intravaginal sponge containing 30 mg of MPA, Group 2= Intravaginal sponge containing 30 mg of MPA + 300 IU PMSG (24 hours prior to sponge withdrawal), Group 3= Intravaginal sponge containing 30 mg of MPA + 300 IU PMSG (at sponge withdrawal), Group 4= Intravaginal sponge containing 30 mg of MPA + 300 IU PMSG (24 hours after sponge withdrawal)

Table 2. Pregnancy rate and litter size of Priangan sheep

Group	Pregnancy rate	Litter Size (head)
1	88.9 % (8/9)	1.6±0.4[a]
2	100.0 % (7/7)	1.3±0.4[a]
3	87.5 % (7/8)	1.3±0.4[a]
4	100.0 % (8/8)	1.0±0.0[b]

[a, b] Different superscript in the same column indicates statistically significant different (P<0.05), Group 1= Intravaginal sponge containing 30 mg of MPA, Group 2= Intravaginal sponge containing 30 mg of MPA + 300 IU PMSG (24 hours prior to sponge withdrawal), Group 3= Intravaginal sponge containing 30 mg of MPA + 300 IU PMSG (at sponge withdrawal), Group 4= Intravaginal sponge containing 30 mg of MPA + 300 IU PMSG (24 hours after sponge withdrawal)

(Timurkan and Yildiz, 2005). Group 1, treated with only MPA, has a similar result to those found in group 3. However, both results are higher than that reported by Turk *et al*. (2008) using 30 mg progestagen-500 IU PMSG combination. The slight discrepancy between the results obtained in the current study and those previous findings may be due to differences in the breed of sheep used and environmental condition, such as season in which the study was conducted.

In the present study, the effects of progesterone combined with PMSG on the reproductive performance of anestrous ewes were investigated. It has been reported that PMSG administration can increase follicle number which leads to multiple births (Gulyuz and Kozat, 1995). Toteda *et al*. (1991) reported that litter size obtained from 400 IU PMSG treated ewes is 66.9% higher than those non-PMSG treated ewes. Moreover, Cruz *et al*. (1991) found a significant difference in litter size between ewes treated using 300 IU PMSG (2.11) and non treated ewes (1.63). However, a surprising result was found in this study, in which PMSG in combination with progesterone administration has fewer litter size than the group to which only progesterone administration.

In group 1, to which only progesterone was administered, the litter size was not significantly different with litter size from G2 and G3, but G4 had the lowest litter size and was significantly different with the other groups. It was assumed that exogenous PMSG interferes the natural process of dominant follicle selection and stimulates the number of the small follicle to increase. However, these follicles vary in terms of quality and response to ovulatory stimulation, such as luteinizing hormone (LH) stimulation. This is in agreement with a previous report that administration of follicle stimulating hormone prevents a spontaneous LH surge and lack of ovulation (Young *et al*., 2003). This present study was not in accordance with the result reported by Anilkumar *et al*. (2010) who found that PMSG administration increased 1.3 of litter size compared to ewes treated without PMSG administration. The reason for these different findings might be due to the physiological condition of the ewes, such as breed, nutrition, and environment. Some researchers elucidated that the use of progesterone has a positive effect on pregnancy and embryo survival rates (Wellace *et al*., 1988; Rajkumar *et al*., 1989). While, the use of progesterone combined with PMSG gives only 30-60 of fertility rates (Earl *et al*., 1985) which might be related to the variation of ovarian follicle quality in response to PMSG induction.

CONCLUSION

We concluded that estrus synchronisation using either intravaginal progesterone sponge or in combination with PMSG is an effective method for improving estrus rate and pregnancy rate of Priangan sheep. Furthermore, administration progesterone-PMSG provides a tighter estrus occurrence thus allowing artificial insemination effectivity. This result offers a model to investigate ovulation induction treatment in response to exogenous PMSG in the small ruminant.

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