Effect of time of Pregnant Mare Serum Gonadotrophin Administration on Oestrus Synchronization Efficiency and Fertility in Blackhead Ogaden Ewes

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Abstract

A study was conducted on 84 Blackhead Ogaden (BHO) ewes to evaluate the appropriate time of Pregnant Mare Serum Gonadotrophin (PMSG) administration in relation to Medroxyprogesterone acetate (MAP, 60mg) sponge withdrawal on oestrous response and fertility. The treatments include administration of 300IU PMSG at (1) Twenty-four hours prior to MAP sponge withdrawal, (2) at MAP sponge withdrawal or (3) control (without PMSG administration). Regardless of the time of administration, oestrous response and pregnancy rate were higher ($P \leq 0.01$) in PMSG administered than control groups of ewes. Similarly, the time to onset of oestrous was earlier ($P < 0.01$) in PMSG administered than in control groups of ewes. However, there was no significant difference ($P \geq 0.05$) in all parameters between PMSG administered groups of ewes. In conclusion, administration of 300IU PMSG either at 24 hours prior to or at MAP sponge withdrawal is important to attain better synchrony of oestrus and increased pregnancy rate from BHO sheep kept under extensive management conditions of Eastern Ethiopia.

Key words: Blackhead Ogaden; ewe; MAP sponges; oestrous synchronization; PMSG

Introduction

The BHO sheep is found mainly in the eastern and south-eastern lowlands of Ethiopia. This sheep breed is the second largest in number next to camels in the lowland areas of Ethiopia. Meat from this breed of sheep plays a vital role in the local economy of Ethiopia and as a source of foreign currency. Apparently, little effort has been made to improve productive and reproductive performances of this sheep breed despite a great ambition of pastoralists to improve productivity by controlled mating (Girma, 1990). To this end, the owners apply traditional practices to match the lambing season with the availability of water and feed to improve the survival rate of the offspring and to match the

slaughter age of animals with the season of highest market demand. However, the traditional attempt to synchronize lambing season with availability of forage and water is not accurate. Thus, the current productive and reproductive performances of the BHO sheep are far below the owners' and the country's needs (Girma, 1990).

Taking into consideration the importance of this specific sheep breed on one hand and lack of scientific information to support the traditional attempts to synchronise oestrus on the other hand, this study was initiated to assess the response of this sheep breed to controlled-breeding techniques practised in other European sheep breeds. Previous study by Zeleke (2003) indicated that oestrus response of BHO sheep to MAP and Fluorogesterone acetate (FGA, 40mg intravaginal sponge treatments for 14 days period to be 90.2 and 93%, respectively. It has also been stated that the two intravaginal sponge types did not have significant difference in inducing oestrus. However, there is a paucity of information regarding the resultant pregnancy rate following intravaginal sponge treatment and time of PMSG administration in relation to sponge withdrawal. Thus, the synchronization efficiency in terms of inducing oestrus and fertility by using MAP sponge treatment and time of PMSG administration relative to MAP sponge withdrawal were evaluated in this experiment.

Materials and methods

Study site

The experiment was conducted at Haramaya University, which is situated 25km from the town of Harar and 42km from Dire-Dawa, Ethiopia. The site is located $9^0$24"N latitude, $41^0$5"E longitude, and at an altitude of 1980m above sea level. The annual total rainfall and the mean maximum and minimum temperatures of the area are 870mm, 22.9^0C and 7.8^0C, respectively (Heluf, 1982).

Experimental animals and their management

One hundred and twenty ewes (2 - 2.5 years and 15 – 26 kg body weight) were purchased from pastoralists. All animals were drenched with a broad-spec-trum anti-helminthes, dipped with a standard acaricide solution for external parasites and were vaccinated against pasteurollosis and anthrax. All sheep were provided with fresh clean water throughout the experimental period and allowed to graze on natural pastures for about 8 hours a day (8:00 h - 12:00 h in the morning and 14:00 h - 18:00 h in the afternoon). At the end of the ad-

aptation period, 84 non-pregnant ewes weighing between 20 and 26 kg were selected and treated with intravaginal MAP Sponges (60 mg; Upjohn) for 14 days.

PMSG treatment

At the end of the MAP sponge treatment period, ewes were randomly allotted to groups of 29, 27 and 28 animals, respectively. The 1st and the 2nd groups were treated with 300IU PMSG at MAP sponge withdrawal and 24h prior to sponge withdrawal, respectively, whereas the 3rd group was kept as a control (administered with sterile physiological solution, i.e. 0.9% NaCl Solution).

Oestrus observation

The signs of oestrus were observed at 8-hourly intervals following MAP sponge withdrawal for a period of 96 hours. Intact rams fitted with aprons were used for heat detection. The ewes were kept in their respective groups, and each group was observed trice daily for a period of 30-minutes. Between 13 and 28 days after AI, all ewes were monitored twice daily for return to oestrus.

AI procedures

Semen was collected from healthy rams with the aid of the artificial vagina. Following each semen collection and prior to its use for artificial insemination, the viability of the sperm was microscopically evaluated according to standard procedures (Watson, 1990). Fresh semen was diluted at a ratio of 1:2 with sterile skimmed cow milk. Cervical insemination with 0.1ml diluted semen (150×10^6 sperm/insemination) at 53-55 hours following MAP sponge withdrawal was performed.

Statistical analysis

The general linear model (GLM) procedures of SAS were used to run analysis of variance test for the effect of time of PMSG administration on the time to onset of oestrus and the duration of the induced oestrus. The categorical modeling (CATMOD) procedures of SAS were used to test the effect of duration of progestagen treatment and time of PMSG administration on pregnancy rate and oestrous response. The treatment means were compared by Duncan's multiple range test (DMRT) as described in Gomez and Gomez (1984).

Results

The effects of time of PMSG administration relative to MAP sponge withdrawal on oestrus response is indicated in Table 1. The response to oestrus was significantly higher (P<0.01) in PMSG treated than in controlled ewes.

Table 1. Effect of time of PMSG administration in relation to Medroxyprogesterone sponge withdrawal on oestrous response in Blackhead Ogaden ewes

Time of PMSG administration	n	Oestrous response (%)
24 hours prior to MAP sponge withdrawal	29	29(100.0a)
At MAP sponge withdrawal	27	27(100.0a)
Control (without PMSG administration)	28	21 (75.0b)
Overall	84	77 (91.7)

[a, b] Values in a column with different superscripts differ significantly (P<0.01)
n number of ewes

The duration of the induced oestrus was not significantly affected by the time of PMSG administration relative to MAP sponge withdrawal. The interval from MAP sponge withdrawal to the onset of oestrus was, however, significantly longer (P<0.01) in control ewes, compared to those treated with PMSG at 24 hours prior to MAP sponge withdrawal or at sponge withdrawal (Table 2).

Table 2. Effect of time of PMSG administration on time to onset and the duration of induced oestrus in Blackhead Ogaden ewes

Time of PMSG administration	n	Time to onset of oestrus (h)	Duration of Oestrus (h)
24 hours prior to MAP sponge withdrawal	29	$32.1^{b} \pm 2.4$	45.6±2.7
At MAP sponge withdrawal	27	$38.2^{b} \pm 2.5$	46.6±2.8
Control (without PMSG administration)	21	$48.8^{a} \pm 2.9$	42.8±3.2

[a, b] Means in a column with different superscripts differ significantly (P<0.01)
n number of ewes

Pregnancy rate was significantly lower (P<0.01) in control ewes, compared to ewes given PMSG administration regardless of the time of administration (Table 3). Furthermore, PMSG administration at the time of MAP sponge withdrawal resulted in a significantly higher (P<0.05) pregnancy rate, compared to the administration of PMSG at 24 hours prior to sponge withdrawal. Similarly, the non-return rate was significantly lower (P<0.05) in control ewes, compared to ewes administered PMSG at 24 hours prior to sponge withdrawal or at MAP sponge withdrawal. There was, however, no significant difference in the non-return rate between ewes administered with PMSG at MAP sponge

withdrawal and those administered at 24h prior to MAP sponge withdrawal. In all cases, the values obtained for the non-return rates were higher than those for pregnancy rates (63.1% vs. 73.8%).

Table 3. Reproductive performance following oestrous synchronisation and artificial insemination in Blackhead Ogaden ewes

Time of PMSG administration	n	Pregnancy rate (%)	Non-return rate (%)
24 hours prior to MAP sponge withdrawal	29	20 (69.0[a])	24 (82.8[a])
At MAP sponge withdrawal	27	20 (74.1[a])	22(81.5[a])
Control (without PMSG)	28	13 (46.4[b])	16(57.1[b])
Overall	84	53 (63.1)	62(73.8)

[a, b] Means in a column with different superscripts differ significantly (P<0.05)
[n] number of ewes

Discussion

In the present experiment, only seven out of 84 ewes failed to exhibit overt signs of oestrus. Three of these seven animals had lost their MAP sponges at one stage of the treatment period although these were immediately replaced. The oestrous response value obtained in this experiment is comparable to the values reported in the literature (Greyling and Brink, 1987; Crosby *et al*., 1991; Greyling *et al*., 1997; Rosado *et al*., 1998; Zarakawi *et al*., 1999). This implies that BHO ewes maintained under traditional management conditions also respond to MAP sponge treatment.

Attainment of significantly higher (P<0.01) oestrous response in PMSG administered ewes, regardless of the time of application, compared to the control (Table 1) in this experiment is in agreement with Knight *et al*. (1992), Artingsih *et al.* (1996), Cordova *et al*. (1999) and Cline (2001) who reported a low dose of PMSG administration results in compact and predictable oestrus in ewes treated with MAP sponges.

The time of PMSG administration relative to MAP withdrawal did not significantly influence oestrous response. This disagrees with the previous results of Zhang and Yuan (1988) who reported oestrous synchronization rate to be 100% in does treated with PMSG 48h prior to MAP withdrawal, compared to does treated with the same amount of PMSG but at sponge removal (66.7%). Probably, the gap between 24 hours prior to MAP withdraws and at sponge withdrawal may be too short to affect oestrous response in the present experiment.

Several factors may influence the extent of the interval between the removal of MAP sponge and the onset of induced oestrus. Generally, oestrus starts at about 36 hours after MAP withdrawal, although some ewes may be in oestrus as early as 24 hours or as late as 48 hours (Gordon, 1997). The overall mean time interval between intravaginal progestagen sponge withdrawal to the onset of oestrus in the present trial (Table 2) is in agreement with Gordon (1997) and Vancleef *et al*. (1998) who reported the time to oestrus to be 36h in ewes. The current result is also fairly comparable to the findings of Greyling *et al*. (1997) in MAP (60mg) synchronized Merino ewes during the natural breeding season (30.5 hours). However, the interval observed in this study was shorter compared to the values obtained by Greyling and Brink (1987) in MAP treated Karakul ewes (62.5±18.7h). This discrepancy in the time of oestrous onset may be due to breed, nutritional and/or seasonal differences.

The significantly shorter ($P<0.01$) interval from MAP withdrawal to the onset of oestrus in ewes administered 300IU PMSG compared to control (Table 2) is in line with the available literature (Zhang and Yuan, 1988; Eppleston, 1991; Knight *et al*., 1992; Artingsih *et al*., 1996), who reported the use of PMSG in combination with progestagen sponges to shorten the time from sponge withdrawal to the onset of oestrus. The shortening of the onset of oestrus in PMSG treated ewes may be due to the hastening effect of PMSG on follicular maturation.

The main focus of controlled reproduction is to obtain optimum fertility rate at prescribed time. Although the average lambing rate recorded in this experiment (Table 3) could not be considered as optimum, it would encourage further study as controlled breeding techniques like artificial insemination and oestrous synchronization have never been tried before in BHO sheep in Ethiopia. In fact, the lambing rate recorded in the present study agreed with the values of Greyling *et al.* (1988) and Hill *et al.* (1998) who reported the mean pregnancy rate following MAP treatment and AI in Merino ewes to be 63.5% and 64.6%, respectively.

The difference between the pregnancy rate and the non-return rate was very big (63.1% vs. 73.8%), probably due to the occurrence of embryonic resorption and/or occurrence of silent heat in some of the experimental animals.

In the present experiment achievement of significantly higher ($P<0.05$) fertility rates (pregnancy and non-return rates) from ewes administered with PMSG, compared to control indicates the importance of PMSG administration

in improving pregnancy rate from oestrous synchronized BHO ewes. The higher fertility rate achieved in PMSG administered groups is in line with many previous works **(**Zhang and Yuan, 1988; Eppleston *et al*., 1991; Knight *et al*., 1992; Artingsih *et al*., 1996; Cordova *et al*., 1999; Cline, 2001). The result of the present experiment, however contradicts the reports of Romano *et al*. (1996), who recorded similar fertility rates between ewes administered 250IU PMSG or no PMSG. Perhaps, 250IU PMSG administered in their study might have been below the threshold level to significantly affect fertility rate. Unlike the previous reports of Zhang and Yuan (1988) who indicated an increase in fertility when PMSG is administered 24 hours prior to pessary removal, compared to PMSG administration at sponge withdrawal, there were no significant differences in fertility rates between the two groups in the current trial. However, the results of the present trial are in agreement with Eppleston *et al*. (1991), who stated that the time of PMSG administration relative to progestagen withdrawal could not improve fertility, except shortening the time of ovulation.

In conclusion, administration of 300IU PMSG either at 24 hours prior to, or at progestagen sponge withdrawal has paramount importance in attaining better synchrony of oestrus and increased lambing rate from BHO sheep kept under traditional management conditions in Eastern Ethiopia.

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