Effects of Gonadotropin Treatment on Incidence of Estrus and Pregnancy Rate in Ewes Synchronized with Synchro-Mate-B (SMB) and Subjected to Laparoscopic Artificial Insemination (LAI) During the Breeding Season

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INTRODUCTION

Animal agriculture must become more efficient to keep up with the ever growing demands for food and fiber in a competitive market. The sheep industry has the opportunity to fulfill part of this need. However, improvement in sheep production technologies have not been greatly utilized. Parker et. al. (1983) reported that fewer than 15% of commercial breeding ewes gave birth to more than one lamb. In 1998, the national average of number lambs born per ewe per year was 1.1, and the number of lambs weaned per ewe was less than one (USDA Economics and Statistics System, 1999).

Artificial insemination (AI) is a useful technique for improving reproductive performance in ewes as well as providing a means to introduce new genetics. Many different techniques have been used for AI; however, direct uterine insemination with the aid of a laparoscope has become the "industry standard" for AI in ewes because of the relatively high conception rates compared to other techniques (Gourley and Riese, 1990). Laparaoscopic AI (LAI) requires the use of estrus synchronization and timed insemination techniques, for LAI otherwise would be virtually impossible from a labor stand-point.

Although many techniques have been used for estrus synchronization in ewes (Wildeus, 1998; Windsor, 1994; Gordon, 1997), perhaps the most widely used technique is that reviewed by Gourley et. al. (1990). This technique uses a synthetic progestin implant to synchronize estrus along with pregnant mare's serum-gonadotropin (PMSG) to stimulate ovarian activity. Insemination is conducted at 58 - 60 hr after removing implants. However, conception rates can still vary widely, most likely due to variation in individual ovarian response to falling progestin levels and response to PMSG. An exhaustive search of the literature could not reveal why PMSG is used for LAI procedures. This study will test the importance of using PMSG at the time of implant removal. In addition, this study is being conducted to

determine if the addition of gonadotropin releasing hormone (GnRH) 36 hrs after implant removal will improve conception rates presumably by tightening the time of ovulation among individual ewes. Preliminary data (Redmer, 1998; unpublished observations) has shown that the use of GnRH in the synchronization procedure described by Gourley and Riese (1990) resulted in an 80% conception rate. According to Murdoch et al. (1998), ewes will ovulate 24 hr after the administration of GnRH.

Data conducted from this study will provide valuable insight into improving the procedures used for timed-insemination in ewes.

MATERIALS AND METHODS

Purebred Hampshire and Montadale ewes were implanted with SMB for 14 days and randomly assigned to one of four gonadotropin treatments (n=20/group) in a 2 x 2 factorial design (+/- PMSG and +/- GnRH). Ewes received i.m. injection of pregnant mare's serum-gonadotropin (PMSG; Folligon, Intervet, Whitby, Ontario; 400 IU) or vehicle (V1) at SMB removal and gonadotropin releasing hormone (GnRH; Cystorellin, Merial, Athens, GA; 25 µg) or vehicle (V2) at 36 hr after SMB removal. Vasectomized rams with markers were penned with the ewes at SMB removal and estrous activity was recorded. All ewes were subjected to LAI at 58-60 hr after SMB removal. Intact rams with markers were turned in with the ewes 10 days after LAI and rebreeding was recorded. Ewes were evaluated for pregnancy 35-40 days after LAI by real-time ultrasonography. LAI was conducted in the months of August and September.

RESULTS

Data regarding synchronization of estrus, estrous return rates, and pregnancy rates are presented in Table 1. No differences were observed among treatments (P>0.10; chi-square test) for any of the variables measured.

Table 1. Percentages in estrus, rebred, and pregnant for ewes synchronized with Synchro-Mate-B and then subjected to laparoscopic artificial insemination following various gonadotropin treatments during the breeding season.*

Treatment	n	Ewes in Estrus (%)	Ewes Rebred (%)	Pregnancy Rate (%)
V1/V2	19	89.5	52.6	47.4
V1/GnRH	20	70.0	40.0	50.0
PMSG/V2	18	77.8	38.9	66.7
PMSG/GnRH	21	90.5	47.6	47.6
Overall	78	82.1	44.9	52.6

*Estrus refers to the estrus after Synchro-Mate-B removal and gonadotropin treatment; rebred refers to breeding mark at next estrus; and pregnant refers to pregnancy diagnosed by ultrasonography at 35-40 days after LAI, and pregnant to LAI.

No differences were observed among treatments (P>0.10) for % Estrus, % Rebred, or % Pregnant by Chi-squared test.

DISCUSSION

These data indicate that treatment with PMSG and/or GnRH does not improve the estrous response or pregnancy rate to timed insemination by LAI in seasonally estrous ewes synchronized with SMB. As stated earlier, PMSG frequently has been used in estrus synchronization programs in sheep. Typically, PMSG is used to stimulate ovarian function in ewes during seasonal anestrous, and is usually used following estrous synchronization. However, some risk occurs with the use of PMSG. Production of antibodies against PMSG may result in ovarian dysfunction, and over stimulation of follicular growth can result in production of multiple births in excess of 2 lambs. Furthermore, PMSG is not commercially available in the USA and is not approved for use in sheep. Therefore, our objective was to determine if PMSG that is commonly used in estrous stimulation/synchronization procedures during seasonal anestrous is necessary for these same procedures during the breeding season. The results from the present study have shown that PMSG had no significant effect on percent of ewes expressing synchronized estrus or on percent of ewes conceiving to LAI, suggesting that PMSG may not be necessary in these procedures.

Since LAI is conducted at a specific time after synchronized estrous (58-60 hrs), it is important that ovulation occur in synchrony among ewes so that insemination time with respect to ovulation time is constant among all ewes. Presumably, this will ensure that the oocytes (eggs) are maximally matured and ready to be fertilized, and that the semen is capacitated and ready to fertilize the oocytes after LAI. A large window in ovulation time will inherently result in lower conception rates because the oocytes may not be at their optimal stage of maturation for being fertilized. Therefore, a second objective of this study was to determine if GnRH, which induces ovulation 24 hrs after treatment, could increase the conception rates to LAI by "forcing" all oocytes to be at approximately the same stage of maturation at the time of insemination. The results from the present study have shown that GnRH had no significant effect on percent of ewes expressing synchronized estrus or on percent of ewes conceiving to LAI, suggesting that use of GnRH has no distinct advantage in this protocol.

An important point to note, however, is that 64 percent of the ewes that expressed estrus after synchronization conceived to LAI, whereas only 53 percent of the total number of ewes conceived to LAI. This indicates that ewes that did not express estrus after synchronization were less likely to conceive to LAI. Therefore, optimizing procedures to improve estrus synchronization response would result in increased conception rates at LAI.

Results from the study herein indicate that there is no advantage to using PMSG and/or GnRH in this particular timed LAI procedure. Whether these hormone serve to improve pregnancy rates in procedures that have different protocols remains to be tested. It is important to note that the data reported herein is based on approximately 20 animals per treatment group. A larger scale study would be necessary to detect small but significant effects. Future studies regarding the optimization of procedures used to synchronize estrus in ewes both during and after the breeding season will provide improved pregancy rates and overall success of these assisted reproductive techniques.

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