OVULATION RATE, FERTILITY AND EMBRYO MORTALITY IN EWES MATED TO RAMS FROM TWO DIFFERENT STRAINS

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SUMMARY

Ovulation rates, pregnancy and embryo mortality were determined in ewes mated with rams from 2 different sources (A and B). Although rams from source A raddled significantly more ewes than rams from source B, the ovulation rates at mating and proportions of ewes pregnant at 17 days after mating were similar for ewes mated to both strains of ram. However, more ewes were pregnant at *65* days after mating with rams from source B than rams from source A, and rams from source A produced higher embryo mortality than rams from source B. There was no difference in the incidence of single and twin pregnancies between ram sources nor the number of fetuses present 65 days after mating. The difference between ram sources in pregnancy and rate of embryo mortality probably had a genetic and reproductive basis inherent to the strains of rams, which may have been enhanced by an interaction with the environment.

Keywords: fertility, embtyo, mortality, mam, strain.

INTRODUCTION

Embryo mortality during the early part of pregnancy is an important contributor to reproductive failure, but it is usually attributed to physiological or environmental factors affecting the female on or about the time of implantation (Kelly 1984). However, Courot and Colas (1986) suggested that the male may also contribute to reproductive failure by affecting embryo survival. When semen quality is low, fertilisation with abnormal spermatozoa may occur resulting in degeneration of the embryo and subsequent embryo mortality.

The role of semen quality as a factor in embryo mortality has been studied by a number of workers. Foumier-Delpech *et al.* (1979, 1981) showed a clear influence of the male in an experiment in which eggs were fertilised by ram spermatozoa from different parts of the epididymis and the fertility was evaluated at different stages of pregnancy. These authors concluded that in eggs fertilised by immature spermatozoa, the fertilisation may be normal but the embryo often dies. Other authors have reported that embryo mortality increased when normal ewes were mated with subfertile rams (Rathore 1968; Howarth 1969; Braden and Mattner 1970).

Another factor which may affect embryo survival is the genetic influence of the male. Such an effect might be manifest between individual rams, or between strains or ram sources. Bradford (1972) suggested that rams may contribute to variation in the litter size of their mates through differences in the fertilising capacity of their spermatozoa or in the pre-natal survival of their offspring. Burfening *et al.* (1977) reported embryo mortality of 11% and 19% respectively from ewes mated to rams born from dams selected for high and low prolificacy. Similar findings have also been reported by Moore (1981), but no differences were found by Baker and Land (1970).

Jefferies *et al.* (1988) mated Merino rams from 3 different sources (studs) to randomly allocated ewes during 2 mating seasons (1986 and 1987) and found no significant differences in numbers of pregnant ewes. However, the rams from different sources caused differences in the number of fetuses present at 12 weeks of pregnancy, and, more surprisingly, in the number of lambs surviving at marking.

The aim of the present study was to examine the effect of ram source on ovulation rate, fertility and embryo mortality in ewes.

MATERIALS AND METHODS

Location and animals

The study was performed between March and August 1989 at the Glenthome Research Station near Adelaide in South Australia.

Groups of 6 Mature rams were randomly selected from average grade rams from 2 South Australian Merino studs (sources A and B). Six hundred Mature Merino ewes from a different source were drafted into 2 groups of 300, identified with plastic ear tags and 2 side numbers, and run together in the same paddock at all times except for mating.

For mating in March, all rams were fitted with Sire-sine harnesses and marking crayons distinguishing their source (A or B). Each group of 6 rams was run with 300 randomly allocated ewes in separate but adjacent paddocks of comparable pasture. The ewes remained in these paddocks for 40 days until they were mated by the rams as indicated by crayon marks.

All sheep were supplemented during late autumn at the same rate with hay and grain for maintenance of liveweight with free access to water.

Recording of crayon marks, ovulation rate and pregnancy

The mated (marked) ewes were recorded and drafted off between 24 and 72 h after marking by the ram. They were then deprived of food and water for 24 h and the ovulation rate determined by laparoscopy. The ewes were then run together for the remainder of the experiment. Pregnancy was diagnosed in the ewes by progesterone assay on day 17 (Robertson and Sarda 1971) and ultrasound on day 65. The difference between pregnancy at days 17 and 65 was used to calculate the percentage of embryo loss.

Statistical analyses

The number of marked and pregnant ewes and twin foetuses were treated using Chi-square analysis. The comparison of sources for pregnancy at 17 and 65 days were analysed by fitting a binomial model.

RESULTS

Rams from source A raddled significantly ($P < 0.05$) more ewes than rams from source B (Table 1). The ovulation rates of the ewes mated to both strains of ram were similar (Table 1).

Table 1. Ewes marked, number of corpora lutea (CL) and ovulation rate in ewes mated to rams from 2 sources

Source of rams	Number of ewes joined	Number of ewes marked (%)	Number of CL	Ovulation rate
A	300	253 (84.3)	366	1.45
B	300	234 (78.0)	333	1.43
Total	600	487 (81.2)	699	1.44

Rams from the 2 sources produced similar proportions of ewes pregnant at 17 days after mating. However, more ewes were pregnant at 65 days after mating with rams from source B than rams from source A ($P < 0.5$, Table 2). Rams from source A produced higher ($P < 0.05$) embryo loss than rams from source B. There was no difference in the incidence of single and twin pregnancies between ram sources nor the number of fetuses present 65 days after mating (Table 2).

Table 2. Ewes pregnant at 17 and 65 days after mating, the incidence of single and twin pregnancies at 65 days after mating, and the rate of embryo loss in ewes mated to 2 sources of rams

Source of rams	Ewes pregnant/ mated (%) 17 days	Ewes pregnant/ mated (%) 65 days	Number of pregnancies Single	Twin	Number of fetuses (% of ewes pregnant)	Ewes pregnant at 17 days but not at 65 days (%)
A	197/253 (77.7)	64/253 (25.3)	38	26	90 (140.6)	133/197 (67.5)
B	181/234 (77.3)	82/234 (35.0)	56	26	108 (131.7)	99/181 (54.7)

DISCUSSION

Although Jefferies *et al.* (1988) reported no differences in fertility between rams from different sources, the present study found an increase in the number of ewes marked by rams from 1 source (A). Mating with these rams also resulted in a lower proportion of pregnant ewes and higher embryo loss than the rams from source B. The embryo loss for both ram groups was very high, but this may have

been due to the frequency of handling, the performance of laparoscopy soon after mating, and a period of extremely hot weather during early pregnancy.

Previous studies (Burfening *et al.* 1977; Moore 1981) have suggested that rams from different strains have different abilities to fertilise single and multiple ovulating ewes. Some rams were less able to fertilise more than 1 ovum, while rams from other strains were able to fertilise 2 or more ova. The progesterone assay we used to detect pregnancy 17 days after mating could not differentiate between single and multiple pregnancies, so our embryo loss figures are likely to be underestimated, and we cannot confirm these earlier studies.

The observation that rams from the 2 sources had similar fertilising capacity but different capacities for producing embryos which survive to become viable offspring supports suggestions that rams may contribute to embryo loss by transmitting lethal genes (Bishop 1964). Edey (1966) reported that there is a basal embryo mortality in sheep of 20–30% which eliminates the less adequate genotypes, and that mortality can be increased above this basal level by interaction with the environment (induced mortality). Induced mortality may have been important in the present experiment because of the abnormal management of the ewes and the heat wave conditions during and after the mating program. It is not known how increased basal mortality due to genotype might have interacted with the induced mortality caused by the environmental conditions of this experiment.

We were not able to estimate whether embryo losses occurred early (before day 30–40) or foetal losses occurred later (days 30–40 to 65). In addition, as teaser rams were not used to detect returns to oestrus, embryo deaths after day 12 could have remained undetected, as cycle lengths would have been extended with progesterone levels remaining elevated at day 17. In this case, the ewe would have been detected as pregnant even though early embryo loss had occurred. Thus, the differences between pregnancy rates at day 17 and 65 may not have been as great as our data suggest.

We conclude that the difference observed between ram sources in pregnancy and rate of embryo mortality may have a genetic and reproductive basis inherent to the strains of rams, and that this may have been enhanced by an interaction with the environment.

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