Animal Reproduction Science 118 (2010) 32–36

Contents lists available at ScienceDirect

Animal Reproduction Science

journal homepage: www.elsevier.com/locate/anireprosci

Lambing rates and litter size following carazolol administration prior to insemination in Kivircik ewes

Mehmet Can Gündüz[a,*,1], Özge Turna[b], Ümüt Cirit[c], Melih Uçmak[b], Çağatay Tek[b], Ahmet Sabuncu[b], Süleyman Bacınoğlu[c]

[a] The Institute of Medical Sciences, University of Istanbul, Cerrahpasa 34303, Istanbul, Turkey
[b] Department of Obstetrics and Gynecology, Faculty of Veterinary Medicine, University of Istanbul, Avcılar 34320, Istanbul, Turkey
[c] Department of Reproduction and Artificial Insemination Faculty of Veterinery Medicine, Universtiy of İstanbul, Avcılar 34320, Istanbul, Turkey

ARTICLE INFO

Article history:
Received 15 October 2008
Received in revised form 1 June 2009
Accepted 8 June 2009
Available online 17 June 2009

Keywords:
Carazolol
Artificial insemination
Lambing rate
Litter size
Sheep

ABSTRACT

The effect of carazolol on the ease of penetrating the cervix during artificial insemination, lambing rate and litter size was studied using 1.5–4.0-year old Kivircik ewes in an incomplete $3 \times 2 \times 2$ experimental design. All of the ewes in this study were synchronized for oestrus by insertion of a progesterone impregnated vaginal sponge for 12 days and administration of 400 IU PMSG at sponge withdrawal. Three methods of service were compared: natural service, artificial insemination (AI) with fresh semen, or AI with frozen semen. Two times of insemination (fixed time AI versus AI at observed oestrus) were compared on the fresh and frozen AI treatments. The absence (control) or use of carazolol (carazolol; 0.5 mg/ewe i.m. 30 min before mating) was the third factor in the design and penetration of the cervix by the insemination pipette was assessed as shallow (<10 mm), middle (10–20 mm) or deep (>20 mm). Natural service ewes were only mated at observed oestrus. Consequently, the factorial design was incomplete and there were a total of 10 treatments each represented by 30 ewes. Natural service resulted in a significantly ($P < 0.05$) higher lambing rate and litter size (86%; 2.0 ± 0.05 lambs/ewe) than AI using fresh (65%; 1.6 ± 0.1 lambs/ewe) or frozen (40%; 1.4 ± 0.14 lambs/ewe) semen. For AI animals the lambing rate and litter size were not significantly different when service was at a fixed time (50%; 1.5 ± 0.12 lambs/ewe) or at observed oestrus (56%; 1.5 ± 0.12 lambs/ewe). Carazolol did not permit complete cervical penetration in any ewe. Deep penetration of the cervix at AI was achieved in 33% of untreated (control) and 48% of carazolol treated ewes ($P < 0.05$). However, the proportion of ewes in which penetration of the cervix and semen deposition was greater than shallow was similar for control (82%) and carazolol (85%), and lambing rate and litter size were similar for both treatments. Over the three service methods, the lambing rate was 56% for control and 63% for carazolol (NS) and litter size was similar for both treatments. It was concluded that the carazolol treatment used prior to natural mating or AI in this experiment did not improve lambing rate or litter size in Kivircik ewes.

* Corresponding author at: İstanbul Üniversitesi Veteriner Fakültesi Doğum ve Jinekoloji AbD Avcılar, Kampüsü, 34320 Istanbul, Turkey. Tel.: +90 533 6347686; fax: +90 212 4737242.
E-mail address: mcg@istanbul.edu.tr (M.C. Gündüz).
[1] Present address: Department of Obstetrics and Gynecology, Faculty of Veterinary Medicine, University of Istanbul Avcılar 34320, Istanbul, Turkey.

0378-4320/$ – see front matter © 2009 Elsevier B.V. All rights reserved.
doi:10.1016/j.anireprosci.2009.06.001

1. Introduction

Artificial insemination (AI), when used in conjunction with accurate progeny testing schemes, can substantially increase the rate of genetic progress (Eppleston and Maxwell, 1993). Such benefits have been clearly demonstrated in the dairy industry (Inskeep and Peters, 1981) and these benefits would also apply to sheep (Clarke et al., 1986). While cervical AI with fresh semen yields acceptable conception rates, the short shelf life of fresh semen, coupled with a natural limitation on the number of semen doses achievable per unit time, restricts the widespread use of individual sires (Gordon, 1997). Therefore, to maximise the genetic benefits through the use of AI, frozen–thawed semen is a prerequisite. Ideally this should be by simple cervical insemination rather than by invasive procedures such as laparoscopy. Unfortunately, expectations of obtaining a fertility rate similar to that obtained with fresh semen are not, or only rarely, fulfilled with cervical AI of frozen–thawed semen (Salamon and Maxwell, 1995b). Low fertility rates following cervical insemination of frozen–thawed semen are attributed to damage to spermatozoa during the freeze–thaw process, resulting in impaired sperm transport, viability and fertilization capacity and increased embryonic mortality (Lightfoot and Salamon, 1970; Salamon and Maxwell, 1995b).

While conception rates in excess of 60% can be achieved with a single insemination of fresh semen deposited at the external cervical os, corresponding values for cryopreserved semen rarely exceed 40% (Salamon and Maxwell, 1995a), with values <20% not uncommon (Windsor, 1999). Cryopreservation reduces the transport of semen through the cervix and synchronization of estrus prior to an insemination program accentuates the reduction in transport (Hawk and Cooper, 1977).

The anatomy and physiology of the ovine cervix, which forms a natural barrier for the uterus, are the main reason for this problem. In the non-pregnant ewe the funnel-shaped rings of the cervix, which averagely found around five in number (Dobson, 1988), are not concentrically aligned, and their openings are constricted in most instances to <3 mm (Halbert et al., 1990). Passage through the cervix using modified inseminating pipettes has resulted in improvements in the conception rate directly related to depth of penetration (Eppleston and Maxwell, 1993; Salamon and Maxwell, 1995b) but can cause significant trauma to the pelvic tissue of ewes where cervical dilation has not taken place (Mylne et al., 1993; Campbell et al., 1996). In only approximately 2% of ewes is complete or deep penetration of the cervix with an insemination pipette achieved naturally, yet such levels of penetration in all ewes are necessary in order to obtain acceptable conception rates with frozen/thawed semen.

Carazolol (l-[carbazol4-yloxy]-3-isopropylamino-2-propanol) is a beta-adrenergic blocking agent with close structural resemblance to adrenalin. When injected i.m., it is rapidly absorbed and its clearance rate is high (Abshagen and Möllendorff, 1980). It has a high affinity for both beta-1 and beta-2 receptor sites (Bartsch et al., 1980) and retains its blocking capability for approximately 12 h (Wengert, 1978).

During delivery, the stimulation of the beta receptors of the uterus causes a relaxation of the smooth muscles and, hence, prolongs parturition. It could be illustrated that the intravenous injection of the adrenaline-antagonist carazolol (0.5 mg, i.e. 1 ml Suacron/50 kg b.w.) increased the contractions of the uterus subpart in sows (Rudloff and Bostedt, 1984).

Spermatozoids move against the mucous flow in the uterus. Interruption or insufficiency of uterine contractions slows down the pace of spermatozoids in the genital canal or delays the arrival of spermatozoids into the oviduct. This plays an especially important role in artificial insemination during which the spermatozoids in the genital canal number less than those found during natural insemination. On the other hand, the lifespan of frozen spermatozoids tend to be shorter than spermatozoids contained in natural ejaculate (Kırsan et al., 1998).

When animals are subjected to stress during artificial insemination due to reasons such as the prolongation of the insemination process, noisy environment or constraint etc., their bodies respond by increasing the adrenaline level. Thus, the stimulation of beta 2 adrenoreceptors in the myometrium by adrenaline eliminates the effect of oxytocin eliciting uterine contractions. This gives rise to the weakening of the uterine tonus, which in turn causes the spermatozoids to take a longer time to pass through the genital canal and to age meanwhile. It is found out that any zygots ensuing out of the fertilization of aged spermatozoids with lower fertile potential are unlikely to survive (Kırsan et al., 1998).

This study examines the effects of carazolol on the conception rates and litter sizes in natural insemination, as well as insemination using either fresh or frozen semen.

2. Materials and methods

2.1. Animals and management

300 Kivircik breed ewes aged 1.5–4 were used. All of the ewes, which were ear-tagged for individual identification, had lambed in the previous breeding season, with the exception of ewes aged 1.5 years, and had been kept at pasture post-weaning. The experiment was carried out during the breeding season. The rams and ewes were kept at the Faculty of Veterinary Medicine, University of Istanbul, Turkey (28°S, 41°W).

2.2. Experimental treatments and design

The experiment was $3 \times 2 \times 2$ factorial design. The factorial design was incomplete and there were a total of 10 treatments each represented by 30 ewes. All ewes were subjected to estrus synchronization by inserting vaginal sponges containing 30 mg of Cronolone fluorogestone acetate (Chronogest, Intervet, Turkey) for 12 days and received 400 IU pregnant mare serum gonadotrophin (PMSG, Intervet, Turkey) i.m. at sponge withdrawal.

Three methods of service were compared: natural service, artificial insemination (AI) with fresh semen, or AI with frozen semen. Two times of insemination (fixed time AI versus AI at observed oestrus) were compared on the