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Effect of season on the superovulatory response in Boer goat does

K.C. Lehloenya [a,*], J.P.C. Greyling [b], S. Grobler [c]

[a] Department of Animal Science, Tshwane University of Technology, Private Bag X 680, Pretoria 0001, South Africa
[b] Department of Animal, Wildlife and Grassland Sciences, University of the Free State, P.O. Box 339, Bloemfontein 9300, South Africa
[c] Department of Obstetrics and Gynaecology, University of the Free State, P.O. Box 339, Bloemfontein 9300, South Africa

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Abstract

This study was conducted to evaluate the effect of season on the superovulatory ovarian response and embryo recovery rate in Boer goat does. Twenty mature does (mean body weight of 55 kg) were synchronised for oestrus with the aid of CIDR devices for a period of 17 days and superovulated with pFSH (Folltropin®-Vetrepharm) during the natural breeding season ($n = 9$) and non-breeding season ($n = 11$). The superovulation treatment entailed a total dose of 200 mg pFSH/doe given i.m. in 7 dosages at 12 h intervals, starting 48 h prior to CIDR removal (the first dose being 50 mg and all others 25 mg). Does were observed for signs of oestrous behaviour 3 times daily at 8 h intervals following CIDR withdrawal with the aid of teaser bucks to determine the onset and duration of the induced oestrous period. Cervical inseminations with 0.1 ml fresh undiluted semen were performed 36 and 48 h following CIDR removal and the embryos surgically flushed 6 days following the second AI. Recovered structures (ova and embryos) were microscopically evaluated and classified according to their morphology. The total number of structures in terms of unfertilised ova, fertilised ova, degenerated embryos and transferable embryos from each doe flushed was recorded. All the donor does exhibited oestrus during the breeding and non-breeding season with the mean period to the onset of oestrus (24.9 ± 4.8 h) being significantly ($P < 0.05$) earlier during the natural breeding season, compared to the non-breeding season (30.5 ± 9.1 h). The duration of the induced oestrous period was also significantly ($P < 0.05$) longer during the natural breeding season (24.0 ± 5.7 h) than the non-breeding season (18.2 ± 3.7 h). The mean ovulation rate per donor, total number of structures and embryos recovered per donor did not differ between seasons. The mean number of unfertilised ova per doe was significantly ($P < 0.05$) higher during the non-breeding season (3.3 ± 2.8), compared to the natural breeding season (0.9 ± 2.4). The total number of degenerated embryos and transferable embryos however, did not differ between seasons. Season as such had an effect on the onset and duration of the induced oestrous period; however, it did not affect the oestrous response. Therefore, it would seem that superovulation in the Boer goats is warranted, irrespective of season.

Keywords: Boer goat; Superovulation; Season; Ovulation rate

1. Introduction

Superovulation is an important phase in a multiple ovulation and embryo transfer (MOET) programme and has the potential to increase the reproductive performance of selected superior donors, especially when the animals are in high demand. In order to realise the commercial application of MOET programmes, a continuous supply of good quality embryos throughout the year is crucial. However, in most countries, MOET in small ruminants (sheep and goats) is limited to the natural breeding season, due to the seasonal cyclic activity of the small stock (Chagas e Silva et al., 2003). In South Africa, for example, it has been reported that Boer goat

* Corresponding author. Tel.: +27 12 3825983; fax: +27 12 3824224.
E-mail address: lehloenyakc@tut.ac.za (K.C. Lehloenya).

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does show peak sexual activity in autumn (short daylight length) and the lowest activity in spring (Greyling and Van Niekerk, 1987). Similarly in certain goat breeds, the highest ovulation rate and embryo yields have been recorded during the natural breeding season and the lowest output recorded during the anoestrous period (Gonzalez-Bulnes et al., 2003a).

Contradictory results have however been obtained in studies designed to determine the effect of season on MOET. There has been general agreement that season has an effect on superovulation in small stock, based on the differences observed in ovarian response, corpus luteum formation and function, circulating LH peaks and serum progesterone concentrations recorded, as well as the number and quality of embryos recovered during different seasons of the year (Pendleton et al., 1986; Walker et al., 1989; Sebastian-Lopez et al., 1990; Mitchell et al., 2002). A higher ovulation rate and number of embryos recovered has also been recorded early in the breeding season, compared to late in the breeding season in goats (Senn and Richardson, 1991). It has also been observed that in goats, the number of large anovulatory follicles following superovulation is more prominent during the seasonal anoestrous period—hence reducing the number of recovered embryos per donor, when compared to the breeding season (Baril et al., 1989). However, this observation may be species specific.

In sheep, the number of anovulatory follicles at embryo recovery following superovulation with eCG has been found to be higher in autumn than in spring and this has led to a lower number of embryos being recovered in autumn, compared to spring (Chagas e Silva et al., 2003). In cattle on the other hand, the number of transferable embryos recovered has been reported to be greatly affected by season (Tegegne et al., 1997). To the contrary, season has been reported to have no effect on the number of corpora lutea, large anovulatory follicles, fertilisation rate, ova and embryo recovered, quality of transferable embryos or the survival rates following embryo transfer in major ruminant species (Greaney et al., 1991; Lopez-Sebastian et al., 1990; Samartzi et al., 1995; Mitchell et al., 2002; Gonzalez-Bulnes et al., 2003b). These observations seem to indicate that MOET programmes can be performed through out the year, without a significant reduction in ovarian response to superovulation and the quality of the embryos recovered.

To highlight the possible use of MOET throughout the year, Greaney et al. (1991) observed a higher ovulation rate outside the natural breeding season in sheep, compared to inside the natural breeding season. The low ovulation rate observed during the breeding season could largely be ascribed to the presence of a large follicle at the onset of superovulation treatment. In sheep the occurrence of large follicles at initial superovulation treatment was found to be more prominent during the breeding season than outside the breeding season. Although the presence of large follicles at the onset of superovulation treatment did not have any effect on the ovulation rate as such, the number and quality of embryos recovered was lower during this period, compared to during the non-breeding season (Gonzalez-Bulnes et al., 2003b). Following these contradictory findings, this trial was thus initiated to evaluate the effect of season on the ovarian response to superovulation in Boer goat does.

2. Materials and methods

This trial was conducted on the University of the Free State's experimental farm, situated approximately 20 km South of Bloemfontein, South Africa located at 28.57° south latitude and 25.89° east longitude, at an altitude of 1304 m above sea level. Twenty mature, multiparous Boer goat does in total were used during the natural breeding season ($n = 9$; autumn—April and May) and the non-breeding season ($n = 11$; spring—September and October) in this trial. The does recorded an average body weight of 55.5 kg during the breeding season and 55 kg in the non-breeding season. All does were allowed to graze on natural pastures (initially improved by hand sowing of Smuts finger grass—*Digitaria eriantha*) during the day and supplemented with milled lucerne ad lib at night, while confined to open pens. For the entire trial period, water was provided ad libitum.

Oestrous synchronisation in all the does was performed with the aid of CIDR devices (Pharmacia & Upjohn, Auckland, New Zealand), inserted for a 17 day period, while does were superovulated with a total of 200 mg pFSH/doe (Folltropin®-Vetrepharm). The superovulation treatment (pFSH) was administered i.m. in 7 dosages, at 12 h intervals, starting 48 h prior to CIDR removal (the first dose being 50 mg and all others being 25 mg). Oestrous detection was performed 3 times daily at 8 h intervals following CIDR withdrawal, with the aid of teaser bucks to determine the response to oestrous synchronisation and the onset and duration of the induced oestrous period. Fixed-time cervical inseminations (0.01 ml fresh undiluted semen – density 3000×10^6 sperm/ml) were performed 36 and 48 h following CIDR withdrawal. The semen used for AI was collected from bucks of proven fertility with the aid of an artificial vagina. The semen collected was evaluated for progressive motility using a microscope (×100 magnification) and only semen samples with a 3+ motility score as described by Avdi et al. (2004), was further utilised for AI.

On day 6 following the second AI, embryos were surgically flushed under general anaesthesia. All does were deprived of feed and water 24 h prior to surgical embryo flushing. Briefly a mid-ventral incision (laparotomy) was made cranial to the udder to exteriorise the reproductive tract and the ovaries were visually examined and the number of *corpora lutea* (*CL's*)