Characteristics of the oestrous cycle and duration of gestation in chital hinds (Axis axis)

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Duration of oestrous cycle and gestation, and characteristics of postpartum oestrus of chital hinds are described. Mean duration of the oestrous cycle of chital hinds was 19.3 ± 1.3 days, with a range of 17–21 days. Serum progesterone profiles are shown, with minimum progesterone concentrations near oestrus less than 2.7 nmol l⁻¹, and maximum luteal values 16–26 nmol l⁻¹. Mean duration of gestation was 234.5 ± 3.0 days (n = 17).

Introduction

Female deer of most temperate species are seasonally polyoestrous (Cowan, 1965; Armstrong et al., 1969; Chapman and Chapman, 1975; Asher, 1985a; Curlewis et al., 1988), and duration of the oestrous cycle varies from 18 to 21 days in red deer (Guinness et al., 1971; Adam et al., 1985; Kelly et al., 1985; Veltman, 1985), 21–22 days in fallow deer (Asher, 1985b; Mulley, 1989), and 22–29 days in white-tailed deer (Chaatum and Morton, 1946; Thomas and Cowan, 1975). There is no information on characteristics of oestrus and duration of oestrous cycle in chital hinds, but their ability to breed all year round (Chapple, 1989) suggests that there would be a constant series of oestrous cycles throughout the year if hinds were not mated.

The duration of gestation of chital hinds has not been accurately determined, with estimates ranging from six to eight months (Hodgson, 1847; Prater, 1965; Graf and Nichols, 1967; Schaller, 1967; Dinerstein, 1980). Furthermore, the interval from parturition to conception has not been described for chital hinds, although they are known to be able to conceive twice within a year (Asdell, 1964; Chapple, 1989).

In this study, serum progesterone concentrations in chital hinds were measured and the duration of the oestrous cycle was estimated. Duration of gestation was also determined and characteristics of postpartum oestrus described.

Materials and Methods

Animals and management

Ten sexually mature hinds of various parity (at least two years old; the precise ages were not known for some of the older hinds) were grazed outdoors on ryegrass and white clover pasture at the University of Sydney Deer Research Unit (34°35'S, 150°43'E) for the duration of this study from February 1987 to April 1988. The hinds had been isolated from stags since April 1986, and the most recent calf was born five months before this study. Duration of gestation was also recorded from eight hinds in another herd at the same site.

Collection of blood samples and detection of oestrus

Blood samples were collected from the hinds between 07.30 and 08:30 h on Monday, Wednesday and Friday each week, from 4 February to 3 April 1987, and from 15 February to 15 April 1988. Hinds were physically restrained for collection of blood samples in a drop-floor cradle. Only nine hinds were sampled in 1988 owing to the death of one hind. The hinds were joined with a fertile stag on 18 March 1987, and blood samples were taken on 10, 15 and 23 July. All hinds calved in November 1987, and were kept away from the stag until after the second period of collection of blood samples in February 1988.

During the sampling period in 1988, a vasectomized stag wearing a crayon mating harness was run with the hinds and, with the assistance of binoculars, the hinds were checked for 30 min three times a day to record crayon mating marks and any mating-related behaviour. All observations of hinds showing possible signs of oestrus were recorded. Such signs included restlessness and constant tail flapping, tending by the stag (for example sniffing, following, grooming, mating) or actively seeking the stag's attention (Chapple, 1989).

Progesterone radioimmunoassay

All blood samples (n = 1154) were analysed for concentrations of progesterone in six successive assays. An extraction radioimmunoassay procedure was used, similar to that described for use in humans (McGinley and Casey, 1979). The assay was validated for chital deer serum using routine methods of radioimmunoassay validation, by serum dilution and addition of cold hormone. Crossreactivities of the progesterone antiserum, raised in sheep against progesterone-11-hemisuccinate BSA, were: progesterone, 100%; 11β-hydroxyprogesterone, 2%;
17α-hydroxyprogesterone and 20β-hydroxy-4-pregnene-3-one, 0.3%; 20α-hydroxy-4-pregnene-3-one and pregnenolone, 0.6%; 5β-pregnane-3α,20β-diol and 5β-pregnane-3α,2α-diol, 0.03%; 17α,17β-dihydroxy-5β-pregnene-20-one, <0.02%; 5β-pregnane-3,20-dione, 1.4%; cortisol, 0.01%; corticosterone, 5.8%; 11-deoxycorticosterone, 6.9%. The only modification in the assay procedure was the use of Keiselguhr (extrelut: Merck, Darmstadt) glass mini-columns (Vining, 1980) for solvent extraction using a 5% diethyl ether:95% petroleum ether solvent mixture. Solvents were of analytical grade and were redistilled before use. The buffer used was sodium phosphate (0.05 mol l⁻¹; pH 7.5) with 0.1% BSA (Armour Pharmaceuticals, USA; fraction V). All samples from an individual animal were assayed in duplicate in a single assay which also contained standardized control sera (Tri-Rac R: American Dade, Miami). The sensitivity of the assay was 0.3 nmol l⁻¹ with 40 nmol l⁻¹ the limit of reading. Extraction efficiency for this assay was 88 ± 5%. The intra- and interassay coefficients of variation were 5 and 10%, respectively.

Gestation
The duration of gestation (n = 17) was calculated from the number of days from observed mating to parturition.

Results
Oestrous cycles and progesterone profiles
In 1988, seven determinations of duration of oestrous cycle in four hinds were made from direct observation of mating activity or crayon marks made on hinds by the harnessed stag. Mean oestrous cycle duration was 19.3 ± 1.3 days with a range of 17–21 days.

Basal progesterone concentrations were measured on each of three occasions when the stag was observed tending a hind (Fig. 1). Mating by the vasectomized stag was observed 16 times for seven hinds during the 1988 sampling period and each corresponded with basal progesterone concentrations (Fig. 2). This indicated that the serum progesterone profile closely reflected duration of the oestrous cycle. Minimum progesterone concentrations near oestrus were less than 2.7 nmol l⁻¹, and the maximum luteal values ranged from 16 to 26 nmol l⁻¹. The mean duration of the oestrous cycle (n = 46), as calculated from the 19 progesterone profiles in 1987 and 1988, was 18 ± 1.4 days. There were no consistent changes in cycle duration over time, and no significant differences among hinds.

Duration of gestation
Duration of gestation ranged from 228 to 239 days, with a mean of 234.5 ± 3.0 days and a median of 235 days (n = 17). Duration of gestation did not appear to be affected by the age of the hind (at least two years) or the sex or birthweight (2.7–4.2 kg) of the calf.

Serum progesterone concentrations at 103–133 days' gestation (calculated from subsequent birth dates) ranged from 19.2 to 28.1 nmol l⁻¹, the concentration for each hind remaining constant over the 13 days of sampling.

Discussion
The 17–21 day oestrous cycle of chital hinds is of similar duration to that of other deer species. Further work is needed to determine whether oestrous cycles at other times of the year are
of the same duration as those measured in this study. The duration of the fallow deer oestrous cycle has been found to increase as the breeding season progresses (Asher, 1985a).

Serum progesterone concentrations have been found to be lowest over the peri-oestrous period in many deer species including fallow deer (Asher, 1986), red deer (Adam et al., 1985; Kelly et al., 1985) and white-tailed deer (Plotka et al., 1980). In fallow does, serum progesterone was no higher than 0.9 nmol l⁻¹ for 46 h around oestrus and fell to the lowest value about 4 h before the onset of oestrus (Asher, 1985b). Detection of low concentrations of progesterone at about the time of oestrus in chital hinds, despite collection of blood samples only every 2–3 days, suggested that the hinds have a prolonged period of low progesterone, at least 48 h. Serum progesterone concentrations in fallow does rose to 9–25 nmol l⁻¹ 12–16 days after oestrus (Asher, 1986). It thus appears that the progesterone profile of chital hinds is similar to that of fallow does.

The 234 ± 3 day gestation in chital hinds is of similar duration to that of other deer species. Reports range from 229 to 234 days in fallow deer (Chapman and Chapman, 1975; Wilson, 1984; Asher, 1985a), 227–234 days in red deer (Lincoln et al., 1970; Guinness et al., 1971; Wilson, 1984; Adam et al., 1985) and 249 days in rusa deer (Van Mourik, 1986).

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