

AASRP Session

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Reproductive management of reindeer (*Rangifer tarandus*)

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Abstract

North American reindeer (*Rangifer tarandus tarandus*) are seasonally polyestrous short-day breeders. Seasonal ovarian activity begins in late August with an estrous cycle length of 24 ± 3.4 days. Estrous synchronization protocols have been published and are similar to protocols in sheep and goats. Artificial insemination has been met with limited success in North American herds. Further studies are needed to establish methods and protocols that provide acceptable conception rates. Pregnancy status can reliably be determined using ultrasonography and serum detection of pregnancy-specific proteins. Gestational lengths vary greatly with reported ranges of 198 to 240 days. During the rut, male reindeer will often cease eating altogether. They exhibit extreme aggression, and even the most docile males cannot be trusted. Rutting behavior includes a grunting behavior accompanied by hunching and urinating on the hind feet. Semen cryopreservation continues to be a challenge in reindeer, with most frozen-thawed samples having very poor motility.

Key words: reindeer, caribou, reproduction

Résumé

Le renne nord-américain (*Rangifer tarandus tarandus*) est une espèce polyoestrienne saisonnière de jours courts. L'activité ovarienne saisonnière débute à la fin d'août avec un cycle oestral d'une longueur de 24 ± 3.4 jours. Les protocoles de synchronisation de l'oestrus ont été publiés et sont similaires à ceux que l'on retrouve chez les moutons et les chèvres. L'insémination artificielle n'a pas eu un très grand succès dans les troupeaux nord-américains. D'autres études sont nécessaires pour établir des méthodes et des protocoles qui permettent des risques de conception acceptables. Il est possible d'établir fiablement le statut de gestation avec l'échographie et la détection sérique de protéines spécifiques de la gestation. La durée de la gestation varie beaucoup et l'étendue rapportée va de 198 à 240 jours. Durant la saison du rut, le renne mâle va souvent cesser de manger. Ces mâles montrent une agressivité extrême et il ne faut pas faire confiance même aux mâles les plus dociles. Les comportements du mâle en rut incluent un gronnement s'accompagnant d'un

courbement du dos et d'urination sur les pieds arrières. La cryoconservation de la semence reste problématique chez le renne car plusieurs échantillons gelés puis dégelés souffrent d'une réduction marquée de la motilité des spermatozoïdes.

Introduction

Reindeer (*Rangifer tarandus tarandus*) and caribou (*R. t. granti*), are relatively recent additions to the deer family. Both are members of the same species, which is further subdivided into 2 main groups, with 7 extant subspecies, all being indigenous to northern latitudes.^{4,14} Reindeer and caribou are unique among cervids because both sexes bear antlers, suggesting that antler development is largely independent of gonadal activity. Antlers are used as a taxonomic feature for the genus *Rangifer*. Males and females show wide variations in body size and weight, and are amongst the most dimorphic of contemporary cervids.

Reindeer have been domesticated for centuries, and provide an economic mainstay for many native populations. In North America, they are primarily kept for meat production and seasonal exhibition. As with other domestic species, owners strive to increase reproductive efficiency.

Because reindeer are managed very extensively, environmental factors interact significantly with fecundity. Current evidence suggests that management of these factors - of which nutrition, reproduction, and herd composition seem to be the most important - will enable the productivity of reindeer herds to be significantly improved. A recent move towards a more intense production of reindeer, using traditional agricultural methods, requires intensified management and enhanced understanding of reindeer reproductive management. A review of both female and male reproductive management will be presented as a guide for practicing veterinarians to understand and address the peculiarities of this species.

Female Reproductive Management

Estrous Cycle

Reindeer, like most cervids, are short-day breeders and are seasonally polyestrous, with an estrous cycle length of approximately 24 ± 3.4 days in North American reindeer.²⁶

Considerable variation has been reported in primiparous Norwegian reindeer with an average estrous cycle length of 19.4 ± 5.7 days.¹⁹ Seasonal ovarian activity is initiated in late August. As in other ruminant species, a small transient rise in plasma progesterone, lasting 4 to 9 days, precedes the first fertile estrous cycle. The detailed endocrine profiles of the estrous cycle in reindeer are generally in accordance with those found in sheep. Some research suggests that some females may experience 2 or more short cycles prior to the onset of full-length cycles.^{4,15}

A peculiarity in reindeer is the relatively short length of standing estrus when compared to that of other ruminants. Studies conducted at the University of Alaska revealed an average standing estrus time of 1 hour (range 1 to 3 hours).^{19,26} Females will continue to cycle well into spring (as late as April), having 6 to 8 cycles through the winter. The transition into anestrus has been reported to occur with abrupt cessation of luteal activity or the formation of a persistent corpus luteum, which can persist into the next breeding season.⁴

As reported in other domestic species, in reindeer the introduction of a bull prior to the initiation of estrous cycles significantly hastens the onset of ovarian activity by 2 weeks, and also results in synchronicity of calving the following spring.²⁶

Estrous Synchronization, Super Ovulation, and Artificial Insemination

Growing interest in the truncation of the breeding season and artificial insemination have largely focused on synchronizing estrus.¹² Among captive reindeer in Alaska, 2 15-mg IM injections of PGF_{2 α} administered 10 days apart resulted in luteolysis, and a single 15-mg injection at 6 weeks after conception terminated pregnancies.⁴

Attempts at artificial insemination (AI) in reindeer have been met with mixed results.⁷ Most published reports give no information on either the methods employed or the results obtained. As with AI in other species, it is labor intensive and requires the ability to collect and store semen, as well as the ability to synchronize or recognize estrus in the female for appropriately timed insemination. Frozen semen AI successes have only been reported in a handful of cases.^{6,24} The use of an ovine controlled drug release device (CIDR) has been described in both 7- and 14-day protocols, with timed artificial insemination occurring 44 to 60 hours following CIDR removal.^{6,10}

In one study, an injection of cloprostenol (250 μ g, IM) administered at CIDR removal and a GnRH injection (100 mcg IM) administered at the time of artificial insemination (44 hours post-CIDR removal) resulted in a 66% pregnancy rate.⁶

Attempts at concurrent super ovulation with follicle-stimulating hormone (FSH) have resulted in a poor recovery rate of only 20%.¹⁶ Another difficulty presented in transcervical artificial insemination is that the reindeer cervix anatomically resembles that of the ewe, thus hindering the ability to readily pass the inseminating tube into the uterus.⁷

Pregnancy Detection

Progesterone

Studies have been published on both Norwegian and Alaskan reindeer detailing the endocrinology of pregnancy. Progesterone concentrations show great variation during pregnancy (range of 2.4 to 14.28 ng/mL), both within and between animals, but do reliably increase immediately after conception to mean levels of 5.89 ± 0.09 ng/mL, where it remains until parturition.^{4,13,20,26} This is consistent with other species that are dependent on luteal progesterone production throughout pregnancy. Studies show that the reindeer placenta does produce progesterone; however, this contribution is not clearly evident in the progesterone profile.⁵ As with other species, cyclic progesterone levels in non-pregnant females can overlap those found in pregnant females and thus make peripheral progesterone an unreliable method of pregnancy detection.⁴

Pregnancy-Specific Protein B (PSPB)

PSPB has been used to successfully detect pregnancy in populations of wild and domestic caribou and reindeer. PSPB appears in maternal plasma at 4.4 weeks (range 4 to 5 wks) after mating.^{21,22} Blood samples should be collected 6 weeks following breeding. Reindeer owners in the continental United States, however, typically wait until after the seasonal reindeer activities and will draw blood for PSPB pregnancy determination in late December.

Transrectal Ultrasonography

Given that reindeer are habituated to handling and restraint, transrectal ultrasonography is a useful modality for pregnancy detection. An advantage of ultrasonography is the application in the field and its ability to produce immediate results. It also allows for fetal measurements and assessment. It is routinely used between 35 and 60 days of gestation, although earlier detection is achievable. Beginning at week 20 of gestation and onwards it can be difficult to detect the fetus, since the gravid uterus is displaced ventrally and becomes unreachable for the ultrasound transducer.

Antler Retention

Retention of antlers in pregnant reindeer cows has long been a technique of wildlife biologists to assess pregnancy status in wild caribou.¹ In reindeer it is not always a reliable predictor of pregnancy. Antler retention into mid-April can be used to infer pregnancy, although the contrary is not true; a portion of pregnant females often cast their antlers prior to calving.^{4,17}

Gestation Length and Parturition

Reindeer have short and highly synchronized mating and calving seasons. Reported gestation length is highly variable. Published ranges range from 198 to 240 days.^{4,18} Variation may be due to environmental and latitude effects or different genetic stocks.

It has also been hypothesized that part of this variability is due to the limited reliability of observations of estrus and breeding, and therefore inaccurate estimates of conception date. Nevertheless, an estimated 90% of reindeer females are mated in a 10- to 21-day interval and give birth in an equally synchronized manner.²³ Several studies have documented a negative correlation between gestation length and conception date.³ Although the underlying mechanisms responsible for this gestational plasticity and enhanced calving synchrony are not fully understood, it is assumed that the primary advantage of synchronized parturition is the fact that fewer neonates are lost to predation.⁹

Twinning is unusual in reindeer and caribou, with a plurality of twins not surviving birth.¹¹ Dystocia is somewhat uncommon in reindeer, but does occasionally happen. As with other cervids and small ruminants, manual correction of the malpresentation can be accomplished easily by a veterinarian. Malpresentations in reindeer are the same as those described in sheep and goats. Successful caesarian sections have been performed in a field setting using a lumbar approach similar to what is commonly used in sheep and goats. Muscular layers of the reindeer abdomen are much thinner than other cervids, and closure is difficult without a surgical assistant aiding in apposition and closure of the lateral abdomen.

Male Reproductive Management

Rut Physiology

Antler development in the male occurs at the rapid rate of 1 to 2 inches of new growth per day. Antlers begin to develop in late winter and continue through the end of July.

The first sign of the pending rut is the cleaning of velvet from the antlers. Bulls will generally begin this process in late August. This process of antler cleaning is triggered by rising levels of testosterone and complete removal of velvet occurs rapidly, often within a 12-hour period. Intense aggressive displays follow with territorial marking and sparring similar to other cervid species. Rut behavior also includes a self-marking display of hunching and urinating on the hind feet, termed trampling-urination, accompanied by distinctive vocalizations referred to as grunting or barking. The rut generally lasts through late November.

Voluntary food intake dramatically decreases at the onset of the rut. Males often will cease eating altogether at the height of rut. Reports suggest that it is common for males to lose up to 23% lean mass.² This body mass reduction occurred in all males over 2 years of age, regardless of social hierarchy. Careful management is required for all males during the rut. It is important to note that even the most docile and tractable bulls will become extremely aggressive and dangerous and cannot be trusted until the rut has ended.

Anesthetic unpredictability is reported in virtually all species of rutting males, but reindeer are particularly susceptible to the effects of cyclohexamines (ketamine) and alpha-2

agonists (xylazine) during the rut. Deaths have been reported from a single 15 mg dose of xylazine.⁴ Whenever possible, general anesthesia should be avoided in male reindeer during the breeding season.

Semen Collection

The use of an artificial vagina and teaser cow have been described for semen collection in reindeer. The use of an electroejaculator has also proven to be a reliable method of collection using a standard ram probe. An unusually high rate of urospermia has anecdotally been reported following electroejaculation of male reindeer.

Reindeer semen is of poor quality when compared with other domestic species. Reported progressive motility in a freshly collected sample is often below 50%, and abnormal spermatozoa approaches 50% on morphological examination.⁸ These deformities seem to be generally equally distributed among primary and secondary abnormalities. Semen cryopreservation continues to be a challenge in reindeer, with most frozen-thawed samples having very poor motility.

Hormonal Control of the Rut

Medroxyprogesterone acetate^b has been used by reindeer owners for many years now to calm male reindeer and reduce aggression during rut.⁴ Although it is not approved for use in reindeer, it is often administered in a set of 2 injections. These are administered in August and October through an intramuscular injection at a dose of 200 to 400 mg per animal. No specific studies have looked at the impact of this drug on spermatogenesis, fertility, semen quality or future breeding.

Antler Development and Casting in Castrates

Unlike many other deer species, reindeer steers continue to grow massive antlers following castration. Steers occasionally experience incomplete velvet removal and delayed antler shedding. Reindeer owners commonly use implants containing 10 mg of estradiol benzoate and 100 mg of progesterone^c placed at the base of the ear of castrates during October. Two pellets are inserted per animal. Steers will rub velvet and cast their antlers in a similar fashion to intact males following treatment. Subsequent antler cycles continue without interruption.

Endnotes

^aLutalyse, Pharmacia and Upjohn Company, Kalamazoo, MI

^bDepo-Provera, Pharmacia and Upjohn Company, Kalamazoo, MI

^cSynovex-C, Zoetis, Parsippany, NJ

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