

# THE DIAGNOSIS OF EARLY PREGNANCY AND MISSED ABORTION IN EUROPEAN AND SVALBARD REINDEER (*RANGIFER TARANDUS TARANDUS* AND *RANGIFER TARANDUS PLATYRHYNCUS*)

*TIDLIG DIAGNOSTISERING AV DREKTIGHET OG SKJULT ABORT I EUROPEISK REIN OG SVALBARDREIN (RANGIFER TARANDUS TARANDUS OG RANGIFER TARANDUS PLATYRHYNCUS).*

TATA RINGBERG Institute of Medical Biology, Department of Arctic Biology, University of Tromsø, 9000 Tromsø, Norway  
ASBJØRN AAKVAAG Hormone and Isotope Laboratory, Aker Sykehus, Oslo, Norway.

*Abstract:* Progesterone levels in peripheral plasma from a total of 38 pregnant and non-pregnant Norwegian and Svalbard reindeer (*R. tarandus tarandus* and *R. t. platyrhynchus*, respectively), were measured 1–6 times between November and May, and the size of 18 corresponding fetuses determined.

The serum levels of progesterone were similar in the two subspecies, and increased from 1.5 nmol/l (non-pregnant level) to 10–30 nmol/l in November in pregnant animals. A maximum of 40–80 nmol/l was reached in April whereafter the levels declined as time of delivery (beginning of June) approached.

Animals with «missed» abortions had progesterone levels in serum of 5–6 nmol/l in November.

The size of the fetuses in November (average 3.7 and 30.7 mm) makes delayed implantation in reindeer unlikely.

*RANGIFER 2(1):26–30*

RINGBERG, T. & AAKVAAG, A. 1982. Tiineyden ja sikiön varhaiskuoleman varhaisesta diagnostisoimisesta eurooppalaisella porolla ja Huippuvuorten peuralla (*Rangifer tarandus tarandus* ja *Rangifer tarandus platyrhynchus*).

*Yhteenveto:* Progesteroni on nisäkkäiden tärkein raskaushormoni ja jo heti raskauden alussa voidaan monilla lajeilla osoittaa veressä tämän hormonin konsentraation kohoaminen. On pohdittu, olisiko tilanne sama myös poron suhteen. Jos niin olisi, olisi mahdollista yksinkertaisen syksyllä otettavan verinäytteen perusteella määrittää onko eläin tiineenä vai ei ja siten hankkia paremmat perusteet teurasvaadinten valinnalle.

Nyt tässä artikkelissa selostettavien kokeiden tarkoituksena oli mitata tiineiden ja mahojen vaadinten veren progesteroni-arvo, jotta voitaisiin havaita, olisiko ensiksi mainitun arvo korkeampi kuin viimeksi mainitun ja edelleen olisiko progesteronitaso ja sikiön koon välillä mahdollisesti tietty riippuvuus.

Kokeissa käytettiin 30, iältään 0,5–2,5 vuotiasta Rørosilaisen poron omistaja John Nordfjellin laumaan kuuluvaa vaadinta sekä kahdeksan Huippuvuorten peura-vaadinta. Norjalaisista poroista otettiin verinäytteet ja sikiöt, kun eläimet teurastettiin 26. marraskuuta 1979. Huippuvuorten peuroista verinäytteitä otettiin 5–6 kertaa tammikuun ja toukokuun välisenä aikana 1980. Peuroja ei teurastettu ja kesäkuun alussa kolme niistä synnytti vasan.

Norjalaisten porojen sikiöt punnittiin ja mitattiin formaliniinfikseerauksen jälkeen. Kaikkien eläinten verinäytteet analysoitiin progesteronin määrittämiseksi Aker-sairaalan keskuslaboratoriossa Osllossa.

Poroilla, jotka eivät olleet tiineinä, havaittiin progesteronitaso kohoaminen 1.5 nmol/l-arvosta lukemaan 10–30 nmol marraskuussa ja tiineillä arvoon 40–80 nmol/l huhtikuussa. Vaatimilla, jotka olivat luoneet sikiönsä, arvo oli 5–6 nmol/l marraskuussa.

Kokeissa todettiin edelleen, että sikiön koon ja vaatimen veren progesteroni-tason välillä ei ollut yhteyttä. Keskimääräinen sikiön pituus (18 sikiötä) marraskuussa oli 30.7 mm ja paino 3.7 g.

*RANGIFER 2(1):26–30*

RINGBERG, T. & AAKVAAG, A. 1982. Tidlig diagnostisering av drektighet og skjult abort i europeisk rein og Svalbardrein (*Rangifer tarandus tarandus* og *Rangifer tarandus platyrhuncus*)

**Sammendrag:** Progesteron er det viktigste drektighetshormon hos pattedyr, og allerede tidlig i drektighetsperioden kan man hos en rekke arter påvise en økning i konsentrasjonen av dette hormon i blodet. Det har vært diskutert om det samme var tilfelle hos rein. Hvis det var så, ville det være mulig ved hjelp av en enkelt blodprøve på høsten å bestemme om dyret var drektig eller ei, og således ha et bedre grunnlag for å velge ut simler for slakt.

Formålet med de forsøkene som er beskrevet i denne artikkel var derfor å måle progesteron-verdiene i blodet hos drektige og ikke-drektige simler for å se om de førstnevnte hadde høyere nivå, og dernest å se om det var en sammenheng mellom fosterets størrelse og progesteron-nivået.

Til forsøkene ble det brukt tretti  $\frac{1}{2}$ — $2\frac{1}{2}$  år gamle simler fra reineier John Nordfjells flokk på Røros, samt åtte Svalbard-rein simler. Fra de norske rein ble blodprøver og fostre samlet under slaktning d. 26. november 1979, og fra Svalbard-reinen ble det tatt blodprøver 5—6 ganger mellom januar og mai 1980. Svalbard-reinen ble ikke slaktet, og i begynnelsen av juni nedkom 3 av dem med kalv.

Fostrene fra de norske rein ble veiet og målt etter fixering i formalin. Blodprøvene av samtlige dyr ble analysert for innhold av progesteron på Sentrallaboratoriet Aker Sykehus, Oslo.

Det ble funnet at progesteron-verdiene økte fra 1.5 nmol/l hos ikke-drektige dyr til 10—30 nmol i november og 40—80 nmol/l i april hos drektige dyr. Hos simler, som hadde mistet kalven (abortert) var verdiene 5—6 nmol i november.

Det ble også funnet at det ikke var noen sammenheng mellom fosterets størrelse og simlas progesteron-nivå i blodet. Den gjennomsnittlige (antall fostre = 18) fosterlengde i november var 30.7 mm og fostervekt 3.7 g.

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## INTRODUCTION

Among the biological enigmas of boreal areas are the large, and apparently natural, oscillations in population size among herbivores (Haukioja & Hakala 1975).

Studies on rodents have shown changes in both fertility and juvenile mortality to be factors involved (Krebs 1963, Christian & Davis 1964). In reindeer and caribou large variations in cow/calf ratios have been found, both between years and between herds, and the influence of environmental conditions upon calving rates appears to be high (Kelsall 1968, Reimers 1977). However, through what mechanisms adverse conditions affect the rate of reproduction in reindeer and caribou is not known: Is it reduced conception rate? Increased neonatal mortality? Or a combination?

One of the reasons for this state of affairs has been the lack of non-lethal methods for the detection of pregnancy in reindeer and caribou; although measurements of Corticoid Binding Protein in plasma as an index of pregnancy have been tried, the results have been equivocal (A. Blom, Inst. of Physiology, The Veterinary College of Norway, unpubl. results), and therefore of little diagnostic value.

In a recent study McEwan and Whitehead

(1980) have shown that progesterone levels may be indicative of pregnancy in Rangifer. However, concomitant hormone levels in non-pregnant animals were not measured. We want to present evidence that measurements of progesterone in peripheral plasma is indeed a highly reliable method for the detection of pregnancy in reindeer event at an early stage. This method not only allows the diagnosis of live fetuses, but also permits the detection of «missed» abortions. Thus, barren females in semidomesticated herds can be selected for slaughter at an optimal time (November/December), and in wild populations of reindeer sampling of blood two or three times through winter will answer the question of whether changes in calving rates are due to variations in conception rate or intrauterine mortality.

This will open the possibilities, through experimental work, of determining some of the physiological factors governing natural oscillations in population size among ungulates.

## MATERIAL AND METHODS

Blood samples from thirty young ( $\frac{1}{2}$ — $2\frac{1}{2}$  years old) female reindeer (*R.t. tarandus*) from the Roros district in Norway were

collected November 26, 1979 during the annual fall slaughter. Fetuses, when present, were immediately preserved in 4% formalin solution.

Jugular blood samples were collected by evacuated tubes from eight captive adult female Svalbard reindeer (*R.t. platyrhynchus*) 5—6 times between January and May, 1980. Of these, three delivered calves at normal term during the first week of June, while a fourth was sacrificed in March and found pregnant. The other four turned out to be barren.

Plasma samples were stored at  $\pm 18^{\circ}\text{C}$  until analysis in June 1980.

The Norwegian reindeer fetuses were measured (head-rump length) and weighed, and all maternal plasma samples were analysed for progesterone according to Torjesen and Aakvaag (1976).

Differences between means were tested statistically by the Student's *t*-test.

## RESULTS

The plasma levels of progesterone in the two sub-species of reindeer are shown in Figure 1. The differences between pregnant, non-pregnant and animals with missed abortions are highly significant ( $p < 0.001$ ), while no obvious differences were found between Norwegian and Svalbard reindeer.

In pregnant animals, the progesterone levels stayed relatively constant at 10—20 nmol/l from November till beginning of March when a 3 to 5 fold increase occurred lasting from mid-March through April. By end of May, about two weeks before delivery, the serum progesterone concentration was down to November level again.

In non-pregnant animals the serum level of progesterone stayed constant between 1 and 2 nmol/l throughout the whole winter/spring period.

Two animals with missed abortions in November had serum progesterone levels between 5 and 6 nmol/l.

The carcass weights of the pregnant females were higher ( $p < 0.01$ ) than those of the

non-pregnant, reflecting a higher percentage of very young (6 mo. old) animals in the latter group (Table 1). The progesterone levels of the very young animals within both the pregnant and the non-pregnant groups were, however, similar to those of the older animals within the respective groups (Table 1).

In Table 2 the weights and lengths of fetuses are shown together with the corresponding maternal progesterone levels in plasma. No correlation between fetal size and maternal progesterone was found. Both weights and lengths of the fetuses were normally distributed around the means.

## DISCUSSION

The serum levels of progesterone in reindeer appear to be of the same order of magnitude as those found in other ruminants, wild or tame (Plotka et al. 1977, Hoffmann et al. 1978). Also the apparent course of the progesterone curve through the gestation period is similar to that of most other mammals (Davies & Ryan 1972).

The differences in progesterone levels between pregnant and non-pregnant reindeer are large enough (10—20 nmol/l vs. 1.5 nmol/l, respectively) for easy discrimination as early as in November. Furthermore, serum progesterone levels of 4—6 nmol/l in November are indicative of abortion.

The importance of giving birth at a time of the year when chances of survival of the offspring are optimal, is self-evident. The phenomenon of delayed implantation, which is not uncommon in nature, is a consequence of fetal development usually going on for a precise and predictable time, while mating not always is synchronized appropriately for the delivery of the young at an optimal time.

Among Cervids, delayed implantation has been demonstrated in the Roe deer (Short and Hay 1966), and some evidence has been presented (Krog and Wika 1980) as to the possibility of the existence of this phenomenon in reindeer, too.

The earliest day of mating of Norwegian

Table 1. Age, carcass weight (slaughter weight) and corresponding plasma progesterone levels of pregnant and non-pregnant Norwegian reindeer.

Tabell 1. Alder, slaktevekt og korresponderende nivå av plasma-progesteron i drektige og ikke-drektige norsk rein.

	Carcass weight±SD(kg) <i>Slaktevekt</i>	Progesterone ±SD(nmoi/l)	
		6 mo. olds	1½-2½ yrs. old
Pregnant <i>Drektig</i>	31.4±5.4 (n=18)	18.3±2.3 (n=3)	20.4±7.1 (n=15)
Non-pregnant <i>Ikke-drektig</i>	23.6±6.3 (n=10)	1.5±0.7 (n=7)	1.4±0.2 (n=3)

Table 2. Fetal length and weight in November (Norwegian reindeer), and corresponding maternal progesterone levels (peripheral plasma).

Tabell 2. Lengde og vekt av foster i november (norsk rein) og korresponderende progesteron-nivå i mordyret.

	No. of fetuses <i>Antall fostre</i>	% of total <i>% av total</i>	Weight±SD (g) <i>Vekt</i>	Length ±SD (mm) <i>Lengde</i>	Maternal progesterone ± SD (nmol/l) <i>Progesteron i mordyret</i>
Large: Weight and length >mean + 1 SD	3	16.7	8.4±1.7	44.0±1.0	17.9±6.0
Medium: Weight and length = mean ± 1 SD	12	66.7	3.7±1.3	30.3±6.1	19.9±7.0
Small: Weight and length < mean - 1 SD	3	16.7	1.1±0.6	18.7±4.0	22.8±6.1
Total material	18	100	3.7±2.6	30.7±9.1	20.3±6.0

reindeer is September 15, the peak of mating activity is in the first weeks of October, and only very rarely does mating take place after November 15 (Skjenneberg & Slagsvold 1968). Thus, in this material, the maximum time of development for the fetuses is between 15 and 75 days, and most probably, between 40 and 60 days. Assuming a positive

relationship between fetal age and size, there is not much room for delayed implantation.

We conclude, that the diagnosis of early pregnancy and missed abortion in reindeer can be made through the measurement of progesterone in maternal plasma at an early gestational stage, and that delayed implantation is unlikely in this species of Cervids.

Progesterone nmol/l plasma

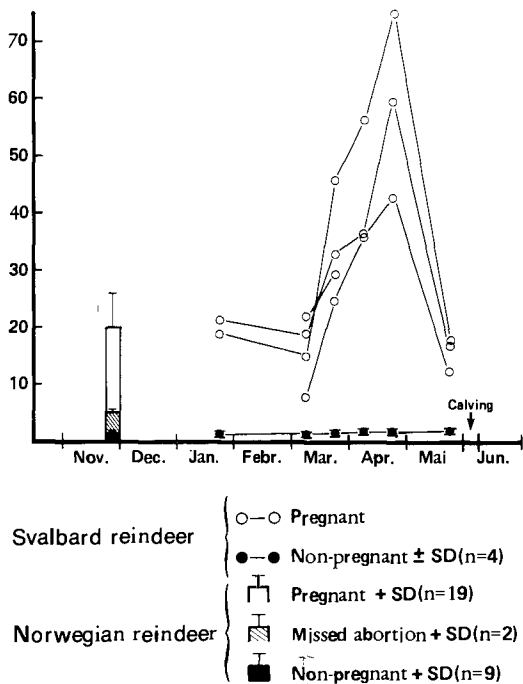


Fig.

Plasma levels of progesterone in female reindeer, pregnant, non-pregnant, and with missed abortion. Samples from Norwegian reindeer were taken at slaughter, serial samples were obtained from Svalbard reindeer.

Plasma-nivå av progesteron i simlerein, drektige, ikke-drektige og etter skjult abort.

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