

# The effect of medroxyprogesterone acetate on pregnancy rates in reindeer calves (*Rangifer tarandus*)

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**Abstract:** In September 1990, a total of 69 calves with a minimum body weight of 46 kg were allocated into two groups, one treated with a single injection of 75 mg medroxyprogesterone acetate (N=35), the other serving as control (N=34). Blood samples were collected for progesterone analysis in December 1990 and 1991. Udder palpation was performed in July and September 1990.

Treated animals had significantly lower plasma progesterone levels in December 1990. The pregnancy rate as determined by udder palpation was 16.7 % for treated animals and 48.3 % for controls ( $P < 0.01$ ). All animals which were found to be pregnant had high progesterone levels ( $> 5$  ng/ml) the following winter. The mean body weight increase was 5.1 kg lower in females which kept their calves until September than in barren females ( $P < 0.05$ ). More than 50 % of the pregnant females lost their calves during the summer.

**Key words:** Reindeer, medroxyprogesterone acetate, anoestrus, hormonal treatment, puberty, progesterone

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## Introduction

In their natural habitat, reindeer generally first conceive in their second year of life and from this age onwards, have pregnancy rates of 70 % or higher (Reimers, 1983). During the development of selection strategies in reindeer flocks, Lenvik *et al.* (1988) found that the pregnancy rate was strongly related to body weight. Within the narrow range from 40 to 50 kg body weight the pregnancy rate increased from close to zero to about 90 % in animals aged 1 1/2 years and older. In Southern Norway body

weights of this size can also be achieved by calves. Therefore a proportion of the calves conceive in their first year of life. The consequences of this have proven to be a very high calf mortality rate and reduced maternal weight gain (Ropstad *et al.*, 1991; Lenvik & Aune, 1988).

Thus, to increase the production capacity of a reindeer flock, growing calves should not be subjected to the risk of pregnancy. One possible way to avoid this problem is by the use of hormonal treatment to either delay the onset of

puberty or to induce luteolysis and abortion at an early stage of pregnancy (Ropstad & Lenvik, 1991).

The aim of the present study was to examine the effects of medroxyprogesterone acetate on ovarian function and pregnancy rates when administered to reindeer calves approximately one month prior to the normal rutting season, followed by a study of the development of treated and untreated calves for 1 1/4 year after treatment.

### Materials and methods

A total of 69 calves with a minimum body weight of 46 kg were randomly allocated into two groups in September 1990, one of which was treated with medroxyprogesteroneacetate (75 mg, im., N=35, Perlutex®), while the other remained untreated (Controls).

The calves were collected four times (December 1990, July 1991, September 1991 and December 1991) during the following 15 months. In December 1990 and 1991 jugular venous blood samples were collected into heparinized vacutainers for the analysis of plasma progesterone as described by Ropstad & Lenvik (1991). The animals were weighed in September 1990 and in December 1991.

Udder palpation was performed in July and September 1991 to assess whether the animals were rearing a calf. An animal was considered to have been pregnant if a lactating udder was diagnosed. Disappearance of the udder between July and September was regarded to be a result of calf mortality. Animals that did not show any sign of udder formation were considered not pregnant.

Using udder palpation as a reference method, progesterone determination was evaluated as a pregnancy test. The sensitivity of a pregnancy test is the proportion of pregnant animals that test positively. The specificity is the proportion of non-pregnant animals that test negatively. The predictive value of a positive pregnancy test is the proportion of pregnant animals among those that test positively.

Statistical analysis was performed by SAS (1985) programmes. Differences among means were assessed by the Kruskal-Wallis test (Chi-square approximation). Data were also examined with conventional Chi-square tests and correlation analysis (the Spearman correlation coefficient,  $r_s$ , was used).

### Results

Treated animals had a significantly lower plasma progesterone level than controls (means were  $1.6 \pm 4.1$  and  $5.3 \pm 4.1$  ng/ml plasma, respectively,  $P < 0.001$ ) four months after treatment with medroxyprogesteroneacetate (Fig. 1a). In both groups the frequency of plasma samples with a high progesterone content increased significantly from December 1990 to December 1991 (Fig. 1).

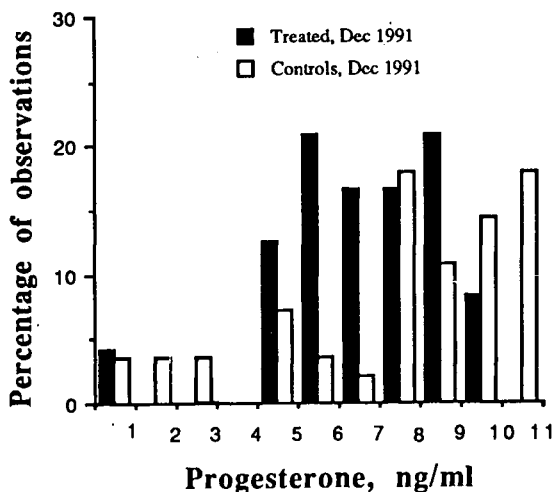
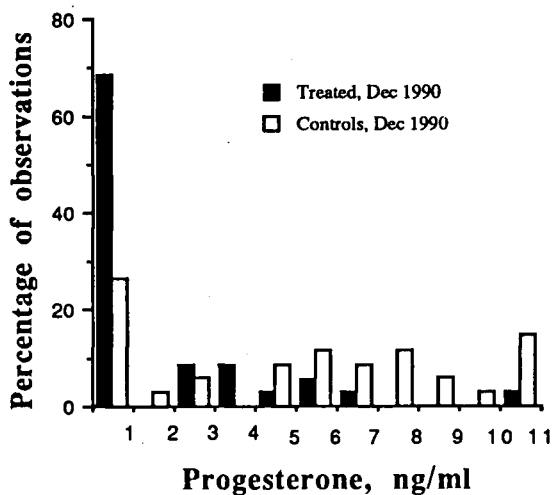


Fig. 1. Frequency distribution (%) of plasma progesterone values in December 1990 and December 1991 for treated and control animals.

Table 1. Body weight increases and plasma progesterone values in reindeer calves as related to pregnancy status and fate of the offspring.

Animal category	Body weight gain	Plasma progesterone Sept	Plasma progesterone Dec
	Sept 1990 - Dec 1991	1990, ng/ml	1991, ng/ml
	Mean $\pm$ SD	Mean $\pm$ SD	Mean $\pm$ SD
Barren females (N=40)	22.0 <sup>a</sup> $\pm$ 6.2	2.9 <sup>b</sup> $\pm$ 3.7	6.8 <sup>a</sup> $\pm$ 2.6
Females which lost their calves (N=11)	21.4 <sup>a</sup> $\pm$ 6.1	5.7 <sup>a</sup> $\pm$ 4.5	10.3 <sup>b</sup> $\pm$ 3.0
Females which kept their calves (N=8)	16.9 <sup>b</sup> $\pm$ 5.2	6.0 <sup>a</sup> $\pm$ 2.4	8.7 <sup>a</sup> $\pm$ 2.2

<sup>ab</sup> Means within columns with different superscript differ significantly ( $P < 0.05$ , Kruskal-Wallis test).

Results of udder palpation were available for 59 animals. The pregnancy rate was 16.7 % for treated animals and 48.3 % for controls ( $P < 0.01$ ). A total of 11 females (57.9 %) which were rearing a calf lost their calves during the summer. All animals which were found to be pregnant had high ( $> 5$  ng/ml) plasma progesterone levels the following winter (December 1991).

At the start of the experiment the average body weights of treated and control animals were  $48.2 \pm 1.4$  ( $\pm$ SD) and  $48.3 \pm 1.7$  ( $\pm$ SD) kg, respectively. The mean body weight change from September 1990 to December 1991 was significantly lower in females which were rearing a calf in September 1991 than in barren females or in females which lost their calves during the summer (Tab. 1). The mean increase in body weight in barren females which received hormone treatment was exactly the same as in barren controls (mean=22 kg for both categories).

In December 1991 the body weight of animals that were weighed immediately after collection (N=26) averaged  $70.9 \pm 6.9$  ( $\pm$ SD) kg. Animals which were fenced (N=26) for about 24 hours prior to investigation had a body weight average of  $68.0 \pm 5.5$  ( $\pm$ SD) kg ( $P < 0.03$ ). A difference was found also in terms of plasma progesterone levels. The mean values were  $6.9 \pm 2.1$  ( $\pm$ SD) ng/ml and  $8.2 \pm 3.7$  ( $\pm$ SD) ng/ml, for those animals weighed immediately and fenced, respectively ( $P < 0.07$ ).

In Figure 2, the progesterone values of December 1990 were evaluated as a pregnancy test. A maximal predictive value of about 0.6 was fo-

und for progesterone when used as a positive pregnancy test. A discriminatory level between 3.5 and 5 ng progesterone/ml plasma was found to give the best accuracy.

## Discussion

The present study showed that it was possible to delay puberty and prevent pregnancy by the use of medroxyprogesterone acetate. The 31.6 % reduction in pregnancy rate for treated animals as compared to controls was, however, considered too low to recommend such treatment for general use.

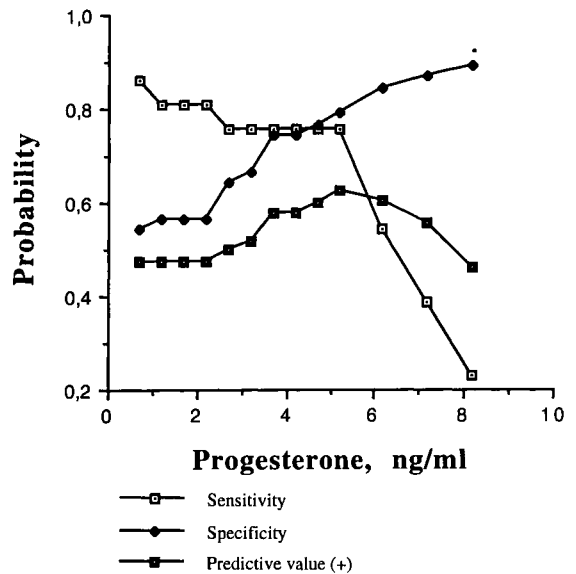


Fig. 2. Evaluation of plasma progesterone values from December 1990 as a diagnostic test for pregnancy. Udder palpation was used as reference method.

To our knowledge, medroxyprogesterone acetate has never been used for the treatment of reindeer. In beef cattle, with an average body weight of 225 kg, Donaldson (1968) found that a single injection of 500 mg medroxyprogesterone acetate prevented oestrus for an average of 6.6 months and pregnancy for 7.6 months. The hormone was less efficient in preventing oestrus and pregnancy in free ranging than in penned animals. Due to the profound effects of light on reindeer reproduction, a prevention of ovarian function of about 5 months (September - January) would probably be enough to prevent pregnancies. Such an effect could possibly be achieved by increasing the dose of medroxyprogesterone acetate.

The pregnancy rate among control animals was somewhat higher than expected. According to earlier findings, calves with a given body weight would have a lower probability of getting pregnant than older animals with the same body weight (Ropstad *et al.* 1991). In the present study, however, the pregnancy rate among control animals fitted very well into a model developed with data from older animals by Lenvik *et al.* (1988).

The weak relationship between progesterone values (December 1990) and udder palpation as methods for pregnancy diagnoses (Figure 2), would strongly underline the need for new and more accurate methods for this purpose. Ultrasonographic investigation is now widely used for investigation of genital organs in several domestic species and could possibly be of great help in diagnosing pregnancies in reindeer.

The high calf mortality (57 %) found in this study is in accordance with earlier findings (Ropstad *et al.*, 1991, Lenvik & Aune, 1988). The result support earlier conclusions, based on both older animals (Lenvik *et al.* 1988) and calves (Ropstad *et al.*, 1991) that calves should not be produced by young females with a low body weight.

This increase in body weight among females that was rearing a calf in September 1991 was surprisingly high (Tab. 1). In a similar study in the same area (Ropstad *et al.*, 1991) the corresponding weight increase was only 9 kg. Under less favourable conditions maintenance or even a loss of body weight is more likely to occur (Lenvik & Fjellheim, 1987). Further studies on the impact of pregnancy and other factors on

body weight changes in young animals would therefore be necessary.

Wild or nearly wild animals should be handled with care. Even mild stressing of the animals could severely influence physiological processes. Attention is drawn to the 4-5 % decrease in average body weight from the first to the second day of collection in December 1991. The increase in plasma progesterone on day two could also be a result of stress associated with fencing of the animals. During stress the adrenals can possibly be the major source of increased plasma progesterone levels (Benjaminsen & Lunaas, 1980).

In conclusion, medroxyprogesterone acetate caused a significant reduction in pregnancy rate. The 31.6 % reduction in pregnancy rate among treated animals was not regarded to be enough to recommend such treatment for general use. More than 50 % of the young females rearing a calf during their second summer of life, lost their calves. Females which kept their calves until September had only a slightly lower weight gain from September 1990 to December 1991 than barren females.

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## References

- Benjaminsen, E. & Lunaas, T. 1980. Plasma progesterone increments in sows treated with ACTH. - *Acta Veterinaria Scandinavica*, 21: 143-145.
- Donaldson, L. E. 1968. Temporary sterilisation of beef cattle by progestational compounds. - *Australian Veterinary Journal*, 44: 499-500.
- Lenvik, D. & Aune, I. 1988. Utvalgsstrategi i reinflokkene. 4. Det tidlige kalvetap relatert til mødrenes vekt. (Selection strategy in domestic reindeer. 4. Early mortality in reindeer calves related to maternal body weight). - *Norsk Landbruksforskning*, 2: 71-76.
- Lenvik, D. & Fjellheim, A. 1987. Utvalgsstrategi i reinflokkene. 2. Ungsimlenes vekt ved 18 måneder relatert til vekten ved 2 og 6 måneder. (Selection strategy in domestic reindeer. 2. Relationship between body weight at 2 and 6 months' old to body weight at 18 months' old domestic female reindeer). - *Norsk Landbruksforskning*, 1: 263-274.
- Lenvik, D., Granfjell, O. & Tamnes, J. 1988. Utvalgsstrategi i reinflokkene. 5. Drektighet hos tamrein i Trøndelag. (Selection strategy in domestic reindeer. 5. Pregnancy in domestic reindeer in Trøndelag county, Norway). - *Norsk Landbruksforskning*, 2: 151-161.

- Reimers, E. 1983. Reproduction in wild reindeer in Norway. - *Canadian Journal of Zoology*, 61: 211-217.
- Ropstad, E. & Lenvik, D. 1991. The use of cloprostenol and prostaglandin F<sub>2</sub> $\alpha$  to induce luteolysis in reindeer calves (*Rangifer tarandus*). - *Rangifer*, 11: 13-16.
- Ropstad, E., Lenvik, D., Bø, E., Fjellheim, M. M. & Romsås, K. 1991. Ovarian function and pregnancy rates in reindeer calves (*Rangifer tarandus*) in Southern Norway. - *Theriogenology*, 36: 295-305.
- SAS Institute, Inc, 1985. *SAS User's Guide: Statistics*. Cary, NC.

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