Remote blood collection in reindeer (*Rangifer tarandus tarandus* L): a preliminary study

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Abstract: Automatic blood sampling equipment (ABSE) was used successfully to collect blood samples from two reindeer. During blood sampling, two methods of restraint were applied which caused no short term changes in plasma concentrations of urea, aspartate aminotransferase, alanine aminotransferase or total protein. Plasma cortisol concentrations were significantly elevated by the two restraint techniques. The value of ABSE in studies of stress in reindeer is discussed.

Key words: Reindeer, *Rangifer tarandus tarandus* L, stress, blood, sampling

Rangifer, 14 (1): 29–32

Introduction

In a semi-domesticated species such as the reindeer (*Rangifer tarandus tarandus* L) management practices such as herding, corralling or physical restraint may have deleterious effects upon welfare (Rehbinder, 1990) and may also result in a reduced meat quality (Warriss, 1992). Whilst the effects of such stressors on behaviour have been conducted in some species of deer (Diverio *et al.*, 1993) measurement of changes in blood parameters might potentially give a better index of the effects.

Conventially such studies require the subject to be restrained to allow collection of blood samples but it is widely recognised that it is almost impossible to measure normal values for some blood constituents of captured and restrained semi-domesticated reindeer as the stress associated with restraint and sampling will influence the vaules (Rehbinder & Edqvist, 1981).

This paper describes the first use of automatic blood sampling equipment (ABSE) in reindeer. This preliminary study considers the effect of the attachment of the equipment and of two physical restraint procedures to assess its potential value in a larger study.

While a number of physiological parameters have been measured in studies on stress there is no consensus as to the most appropriate measures to use when examining situations which may compromise animal welfare. In this study measurements where made of plasma concentrations of cortisol, urea, aspartate aminotransferase (ASAT), alanine aminotransferase (ALAT)

and total protein (TP). Cortisol is widely regarded as a useful measure of the stress response (Folkow *et al.*, 1967). Urea was measured to determine any metabolic consequences of the procedures. The enzymes ASAT and ALAT are found in skeletal muscle and an elevation in the plasma indicates muscle damage. The enzyme ASAT in particular has been reported to become elevated in association with capture myopathy (McAllum, 1985). Total protein was measured to determine whether the animals became dehydrated over the sampling period.

Materials and methods

Two 18-month old male reindeer (G & W), weighing 64.5 and 69.5 kg respectively, from the herd maintained at the Vuolda reindeer research station, Arjeplog, were used in the study. They were housed in individual stalls the previous day. Food (silage and lichen) and water were available *ad libitum* until immediately prior to attachment of the equipment at 10.00 h and again from 12.30 h.

Pre-programmed automatic blood sampling equipment (Mayes *et al.*, 1988) was used to collect blood samples. ABSE continuously samples blood through a coaxial catheter. The blood is partitioned into separate packs at pre-determined intervals; in this case 10 ml of blood was collected over each of 12 successive 30-minute periods. To prevent clotting, an isotonic saline solution containing lithium heparin (100,000 IU/l) was infused through a tube situated in the coaxial catheter to bathe the tip of the catheter. The ABSE was attached to a harness fitted to the reindeer with webbing straps under light physical restraint. Subsequently a 13 G 110 mm catheter was inserted into the jugular vein and sutured to the skin. The ABSE was then attached to the catheter. The total weight of the ABSE and harness was 2.5 kg.

Following attachment of the equipment, the animals were left undisturbed for two hours (samples 1–4). They were then physically restrained. The first method of restraint involved either holding the antlers (Reindeer G) or using a halter (Reindeer W) for 15 minutes, after which the reindeer were left undisturbed for 1¾ hours (samples 5–8). The animals were then both restrained for a further 15 minutes

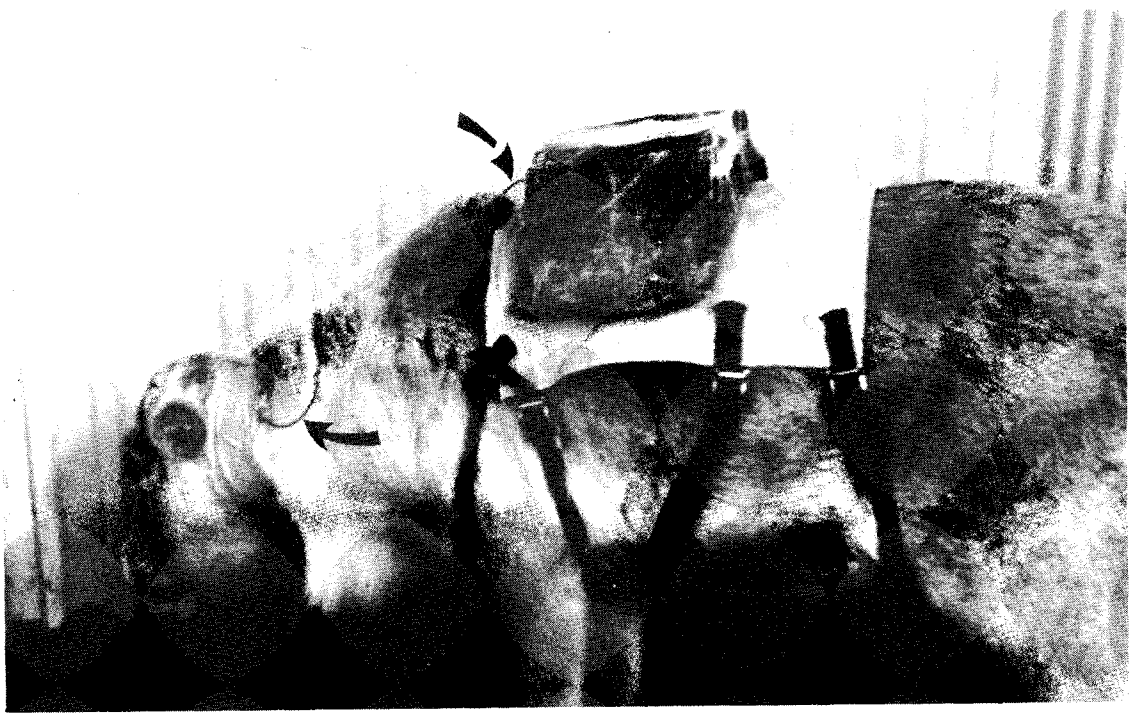

Fig. 1. Reindeer with ABSE attached to a harness fitted to the animal with webbing straps. Note catheter (arrows).

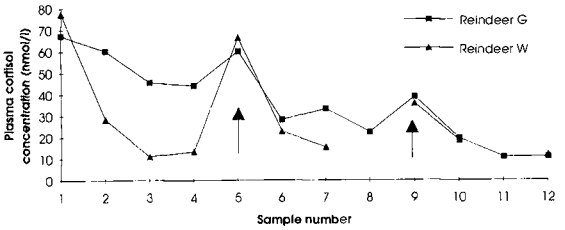

Fig. 2. Effect of restraint (at arrows) on plasma cortisol concentration.

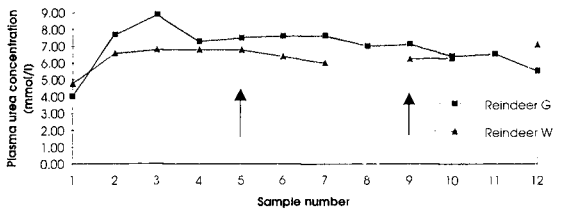

Fig. 3. Effect of restraint (at arrows) on plasma urea concentration.

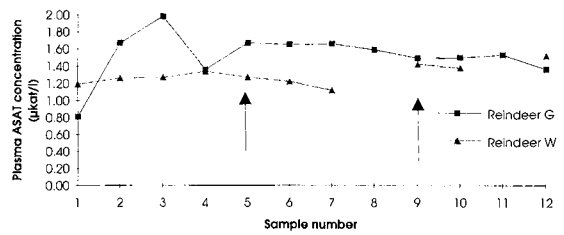

Fig. 4. Effect of restraint (at arrows) on plasma ASAT concentration.

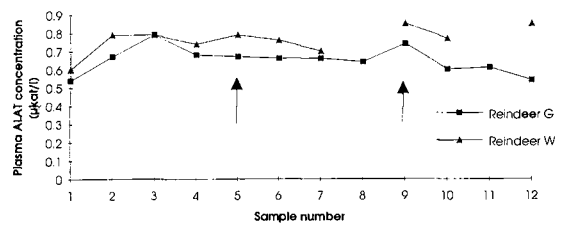

Fig. 5. Effect of restraint (at arrows) on plasma ALAT concentration.

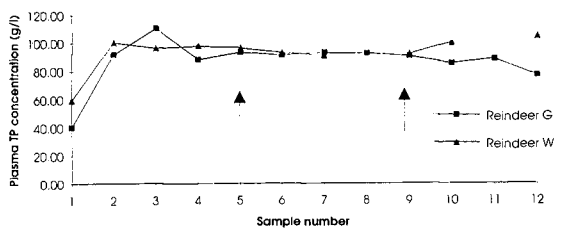

Fig. 6. Effect of restraint (at arrows) on plasma TP concentration.

using a second method of restraint which involved holding them with a thumb in the interdental space and under the tongue. This method is commonly used by reindeer herdsmen as a good method of quiet restraint. The animals were then again left undisturbed for 13/4 hours (Samples 9–12).

At the end of the sampling period of 6 hours the ABSE was removed and the blood samples collected. Plasma was removed following centrifugation at 3000 rpm for 10 minutes and later stored at -20°C before being analyzed for cortisol, urea, ASAT, ALAT and TP.

Concentrations of blood constituents in individual samples were corrected for the dilution due to the heparin infusate, based on the lithium content in relation to that infused.

Results

The ABSE in situ is shown in Figure 1. Neither animals appeared to be greatly disturbed by the presence of the sampling equipment and ate and lay down during the study. We did not observe any behaviour directed at removal of the ABSE as seen among red deer (*Cervus elaphus* L.) (P. J. Goddard, unpublished data).

From a possible 12 samples, all were collected from reindeer G and 10 from reindeer W. The results of the biochemical analyses are presented in Figures 2–6. Plasma concentrations of urea, ASAT, ALAT and TP were relatively stable over the entire sampling period and there were no detectable effects of the restraint procedures. After an initial decline following attachment of the ABSE both methods of restraint caused an elevation in cortisol concentrations. When the values obtained during restraint (samples 5 and 9) were combined and compared (using the Student's t test) to the vaules immediately before and after, the levels of significance were 0.06 and 0.02 respectively. There was no significant difference in the rise in plasma cortiso concentration between the different methods of restraint although there was a tendency for restraint using the thumb to cause less of, an elevation in plasma cortisol concentration (sample 9).

Discussion

The use of a technique which overcomes some of the constraints of conventional blood sampling is likely to prove extremely valuable in physiological studies of stress and welfare. In

this pilot study reindeer tolerated automatic blood sampling equipment and a high success in sample recovery was achieved, albeit in a well controlled environment. The recovery of 22 out of 24 possible samples was very successful in relation to both the complexity of the system and equivalent studies in red deer (*Cervus elaphus* L.) and sheep (P. J. Goddard, unpublished data).

Problems may occur if ambient temperatures fall much below 0°C and precautions would be required to prevent freezing.

The stable levels of urea, ASAT and ALAT recored were all at the lower end of the range reported by Rehbinder and Edqvist (1981), suggesting that there was neither an effect of connecting the ABSE nor of the two restraint procedures on muscle damage in the short term. In stressed animals, reduced urinary excretion or increased urea production can occur because of increased protein catabolism (Rehbinder & Edqvist, 1981) but the stable concentration of plasma urea in this study indicates no such change occurred. Also the constant plasma total protein concentration indicates that no dehydration occurred over the sampling period.

The plasma cortisol concentrations are particularly interesting for two reasons. Firstly, within 1½–2 hours of ABSE attachment the animals appeared to establish a stable baseline cortisol output at a level above that of reindeer shot before sampling but below that of animals accustomed to human presence and handling before acute sampling collection (Rehbinder & Edqvist, 1981). Secondly, the two restraint procedures (which involved minimal physical disturbance) caused significant elevation in plasma cortisol concentrations. This suggests that analysis of plasma for cortisol following collection by conventional methods may reflect the effect of the sampling technique itself in addition to any underlying treatment effect.

It is, however, important to remember that the disturbance caused by ABSE attachment may also have an effect on the parameters measured and further information on this is needed in reindeer. Also since samples remain in the ABSE on the back of the animal until the ABSE is retrieved, it is important to be aware of the potential degradation of the constituents measured.

In conclusion, the use of an automatic blood sampling system offers a potentially valuable new approach to monitoring stress in reindeer and overcomes many of the problems of restraint required for normal sampling.

Acknowledgements

We would like to acknowledge the help of A. J. Macdonald in preparing the ABSE and Anna Nilsson for help with handling the reindeer.

References

Diverio, S., Goddard, P. J., Gordon, I. J. and Elston, D. A. 1993. The effect of management practices on stress in farmed red deer (*Cervus elaphus*) and its modulation by long-acting neuroleptics: behavioral responses. – *Applied Animal Behaviour Science* 36: 363–376.

Folkow, B., Hedner, P., Lisander, B. and Rubenstein, E. 1967. Release of cortisol upon stimulation of the hypothalamic «defence area» in cats. – *In.* Emotional stress, physiological and psychological reactions, medical, industral and military implications. L. Levi (Ed.). Proceedings of an international research symposium arranged by the Swedish Delegation for Applied Medical Defence Research, Stockholm. February 5–6, 1965. *Fôrsvarsmedicin, 3: (Suppl. 3)* 114–119.

Mayes, R. W., Lamb, C. S. and Colgrove, P. M. 1988. Equipment for estimating carbon dioxide turnover rate in undisturbed grazing sheep. – *Proc. Nutrition Society* 47: 136a.

McAllum, H. J. F. 1985. Stress and postcapture myopathy in red deer. – *Biology of Deer Production, The Royal Society of New Zealand, Bulletin* No. 22: 65–72.

Rehbinder, C. 1990. Management stress in reindeer. – *Rangifer. Special Issue* No. 3: 267–288.

Rehbinder, C. and Edqvist, L. E. 1981. Influence of stress on some blood constituents in reindeer (*Rangifer tarandus* L.). – *Acta. vet. scand.* 22: 480–492.

Warriss, P. D. 1992. Animal welfare: Handling animals before slaughter and the consequences for welfare and product quality. – *CABI & IFIS Meat Focus International July, 1992:* 135–138.

Manuscript accepted 15 February, 1994.