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Activity and heart rate in semi-domesticated reindeer during adaptation to emergency feeding

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Abstract

Although reindeer are well adapted to limited food resources during winter, semi-domesticated reindeer are regularly fed when snow conditions are bad in order to prevent starvation. Feeding sometimes results in health problems and loss of animals. This study was made to assess if activity pattern in reindeer could be used as a tool for the reindeer herder in early detection of animals that are not adapting to feeding. The frequency of 10 behavioural categories was recorded in five groups of penned, eight-month-old, female semi-domesticated reindeer. Three reindeer per group were fitted with heart rate monitors. Lying was the most frequent behaviour, whilst there were few cases of agonistic behaviour. Heart rate varied during the day, with peaks during feeding and low heart rates in the early morning. Restricted feed intake resulted in more locomotion and seeking but less ruminating compared to feeding ad libitum. This was followed by a generally lower heart rate in reindeer in the restricted groups compared to controls. Subsequent feeding with different combinations of lichens, silage and pellets ad libitum resulted initially in significantly more of the animals lying curled up, compared to controls, combined with increased heart rates. As the experiment continued the general activity pattern, as well as the heart rate, gradually became more similar in all groups. Lying curled was the behavioural indicator most consistently affected by feed deprivation and adaptation to feeding and may thus be a useful indicator to distinguish individual reindeer that are not adjusting to feeding.

Keywords: Activity; Adaptation; Behaviour; Energy; Feeding; Heart rate; Outdoor temperature; *Rangifer tarandus*; Reindeer

1. Introduction

Most reindeer in Fennoscandia are semi-domesticated and normally kept on natural ranges. Reindeer are considered to be well adapted to large variations in nutrient supply over the year [1,2]. However, critical situations arise when the ground vegetation becomes unavailable, due to deep snow or the formation of an ice crust [3]. During such conditions it may be necessary to rapidly provide alternative feed to the reindeer in order to prevent starvation. A changing climate may result in more icing over in winter [4], thus further increasing the need for emergency feeding. Most feeds available for emergency situations differ substantially from the natural diet; the lack of proper time for adaptation to these feeds often results in health problems (reviewed by e.g. Josefsen [5]) and even the death of animals [6,7]. Some diets may also be insufficient with respect to digestibility or nutrient content and therefore cause problems for the animals if the feeding has to continue for a long time [8,9].

The physiological effects of poor adaptation or unsuitable feed are usually difficult for the reindeer herder to detect at an early stage, whereas changes in the behaviour and activity of the animals is easier to observe. Reindeer fed unsuitable feeds have shown signs of either voracious appetite or of becoming passive and apathetic [8–10]. Excessive intake of snow [11] and aggressive behaviour [6] has also been observed in connection with inadequate feeding. Changes in behaviour and activity may thus be valuable indicators of nutritional disorders and could be

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Table 1
Number of animals, and cause of exclusion, in each group at different periods of the experiment

Day no.	C	L	PL	PS	SP	Cause of exclusion (no. of animals)
Restriction period						
1	13	12	12	12	12	
5	13	12	12	11	12	Injured and infected leg (1)
9	13	11	12	11	12	Infected mouth wound (1)
Feeding period						
10	10	10	10	10	10	Planned slaughter (9)
11	10	10	10	10	9	Malnutrition (1)
13	10	10	10	10	8	Wet belly (1)
21	10	10	10	9	6	Injured eye (1); wet belly (2)
22	10	10	10	9	5	Wet belly (1)

used in experimental situations as well as by the reindeer herders. In the common practical situation, the reindeer herder often keeps several hundred reindeer together during feeding and the animals are usually observed at some distance. Identification of characteristic behaviours connected to poor health or inability to adapt to feeding would make it easy for the reindeer herder to discover problems at an early stage. The herder would then have a better chance to introduce measures in time and thus prevent animals from suffering or dying.

This study was made as a part of a larger investigation where we also studied feed utilization, gains and losses of body mass and tissue depots [12,13], rumen metabolism [14] and health [15] in reindeer fed different diets after a period of feed deprivation. Severe health problems occurred in some of the animals that were fed diets to which they were not adapted. The diets were chosen based on common reindeer herding practise. The number of experimental animals used was a balance between enough animals for a dependable sample size and the ethical issue of subjecting reindeer to the treatments involved.

In the present study the frequency of different behavioural categories was observed in the reindeer at certain intervals, to assess if and how the activity pattern of the animals was affected by short-term nutritional deprivation and by the adaptation to various feeding strategies. Continuous recordings of heart rate (HR) were made to examine whether the behaviour recorded during the focal observations was reflected in the overall activity of the animals. The aim was to evaluate whether systematic studies of behaviour could be used as indicators of nutritional stress or incipient health problems in reindeer during feeding.

2. Materials and methods

2.1. Experimental design and diets

The experiment was conducted at the research station of the Department of Biology, University of Oulu, Finland (latitude 65°N, 25°N), in the winter of 1996–1997. The study included 61 semi-domesticated reindeer (*Rangifer tarandus tarandus* L.). The reindeer were brought to the research station between 12 November and 7 January and randomly allocated to five groups (12–13 animals per group). From arrival until 27 January (pre-experimental period), all reindeer were offered a lichen-based diet ad libitum, consisting of 80% lichens, *Cladina* spp., and 20% of a mix of shrubs, *Vaccinium myrtillus*, and leaves, *Salix* spp.

A control group (group C) was offered the lichen diet ad libitum throughout the experiment. From day 1 to day 8 of the experiment, the other four groups were given half of the ad libitum ration followed by one day (day 9) of total feed deprivation (days 1–9 are referred to as the restriction period). Nine reindeer, randomly chosen at the start of the experiment, were

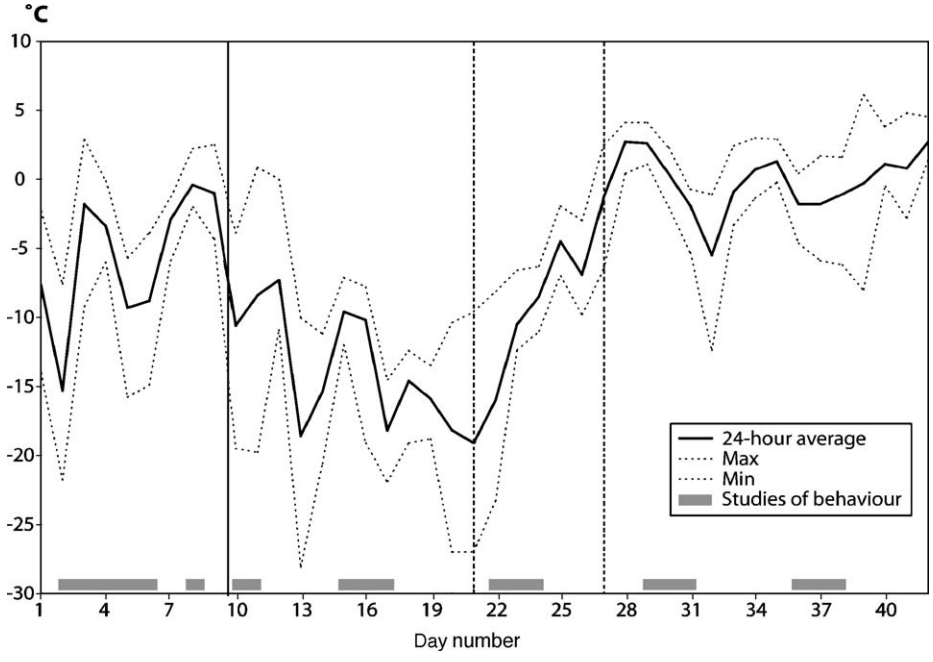

Fig. 1. Daily average, minimum and maximum outdoor temperatures (°C) during the experiment. Days when behaviour studies were performed are indicated on the *x*-axis.