

The 11th Arctic Ungulate Conference,
Saariselkä, Finland, 24-28 August, 2003.

Brief communication

Behaviour of reindeer as an indicator of an adaptation to feeding¹

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Abstract: We assessed behaviour of reindeer affected by nutritional deprivation and how they adapted to various feeding strategies. The activity pattern of 61 penned eight month old female reindeer calves was observed during 20 of a total of 42 experimental days in winter 1997. The dominant activities were lying, ruminating, intake of feed and water, and standing. Few recordings of agonistic behaviour or snow intake occurred. Restricted feed intake, half the *ad lib.* ration of a lichen-based diet, affected the eating behaviour of the reindeer, and more animals were standing and fewer lying compared to reindeer fed *ad lib.* Lack of energy in the diet correlated with animals lying curled up (lying with the muzzle close to the hind legs). This behaviour could be a useful complement to other measurements and registrations when studying adaptations to various feeding regimens.

Key words: activity, diet, energy, *Rangifer tarandus*.

Rangifer, 24 (1): 21-24

Introduction

Occasionally, ground vegetation becomes unavailable to reindeer due to deep snow or formation of an ice crust, and it is necessary to feed the animals to prevent starvation. Changes in feed and environment necessitate time for proper adaptations and therefore emergency feeding often results in associated health problems and animal mortality (Staaland & Sletten, 1991). The adaptation of reindeer to feeding with the focus on single measurements as blood plasma concentrations (*e.g.* Soveri *et al.*, 1992), body weight (*e.g.* Nilsson *et al.*, 1996) or rumen metabolism (*e.g.* Olsen *et al.*, 1995) has been studied in several experi-

ments. However, most registrations require handling and often restraint of the animals that may be stressful and influence the results (Sire *et al.*, 1995). The behaviour of the animals is an alternative stress indicator that can be used without handling or disturbing the animals (Kosmo *et al.*, 1978).

In a more comprehensive experiment, the adaptation of reindeer calves to feeding was studied to detect how the entire animal was affected. A wide range of sampling procedures were performed (Nilsson, 2003). The present part presented here assess whether behaviour of reindeer was affected by nutri-

¹ Article of oral presentation based on material from Nilsson's PhD dissertation (Nilsson, 2003).

tional deprivation and how they adapt to various feeding strategies.

Material and methods

Experimental design and animals

The experiment was conducted at the research station of the Department of Biology, University of Oulu, Finland, during January to March 1997. The present study included 61 eight-months-old female reindeer (*Rangifer tarandus*). At least three weeks before experimental start, all reindeer were offered a lichen based diet *ad lib.*, consisting of 80% lichens, *Cladina* spp., and 20% of a mix of shrubs, *Vaccinium myrtillus*, and leaves, *Salix* spp. A control group was offered the lichen diet *ad lib.* throughout the experiment. From day 1 to day 8 of the experiment, the other four groups were given half of the *ad lib.* ration followed by one day (day 9) of total feed deprivation (the restriction period). From day 10 to day 42 (the feeding period), four feeding strategies were tested on the previously feed-restricted animals. One group was re-fed the lichen diet *ad lib.* Two groups were fed diets of 80% commercial pellet reindeer feed (pellets). The pellets were either combined with 20% lichen or 20% silage. The offered amounts of the pellets-based diets were gradually increased to *ad lib.* levels during the first week of feeding. The fourth group was fed silage *ad lib.* for five days and thereafter adapted gradually to a diet of 80% pellets and 20% silage. The daily intake of metabolizable energy when the ration was given *ad lib.* was 13 MJ for the lichen based diet and 18 MJ for the pellets based diets (Nilsson *et al.*, 2000). The animals were fed twice a day and had free access to warmed water (10 °C). All animals in the study were kept outdoors in pens (500 m²) and the ground was covered with snow. The Committee on Animal Experiments at the University of Oulu, Finland, approved the experimental procedures and the handling of the animals.

Behavioural observations

Recordings of behaviour were done during 20 of the 42 experimental days, 6 days during the restriction period and 14 days during the feeding period. The observations were performed in two separate sessions, morning (09.00 - 11.00) and afternoon (13.00 - 15.00), per day. Each session included six observations per group. The behaviour of each group was recorded using an interval observation technique with instant observations. No handling of the animals were done during the observation days and no humans were inside the pens during the observation sessions.

The following behavioural categories were registered: Standing: standing without performing any additional behaviour.

Locomotion: walking or running.

Intake of food or water: animals inside the feeding area ingesting feed or water from the cribs, or chewing feed close to the feeding area.

Seeking: standing, walking around and scratching in the snow while the muzzle is less than 0.2 m from the ground.

Snow eating: taking in, chewing or swallowing snow from the ground.

Agonistic behaviour: interaction between two or more animals, butting, kicking or chasing each other. Also between individuals from neighbouring groups through the fence.

Lying: lying without performing any additional behaviour.

Lying curled up: lying with the muzzle close to hind legs.

Ruminating: lying and chewing regurgitated feed or in the process of regurgitation.

Other: behaviours not included in any other category.

Results and discussion

The most frequently observed behaviours, were "lying doing nothing else" (with a relative frequency of 0.10 - 0.60 of the observation time) and "lying ruminating" (0.06 - 0.26). Reindeer have previously been observed to spend about 50% feeding and 35% resting out of each 24 h winter day when free-ranging (Collins & Smith, 1989), while more than 50% lying down, resting or ruminating in an experiment with fed reindeer (Mesteig *et al.*, 2000). The few recordings of agonistic behaviour and snow eating, with frequencies below 0.01, were in disagreement with other reports (Kosmo *et al.*, 1978; Nilsson *et al.*, 1996; Aagnes & Mathiesen, 1994), but the homogenous groups of animals and the continuous access to drinking water could be possible explanations for these results.

Restricted feed intake affected the reindeer behaviour similarly in all four groups, with more animals walking and seeking but fewer lying and ruminating compared to the control group. Also the eating behaviour changed, as the restrictedly fed animals ate the coarse parts of the lichens and the shrubs that were rejected when the diet was offered *ad lib.* (Nilsson *et al.*, 2000). During the initial phase of the feeding period, the previously feed restricted groups had a less active behaviour pattern and spent significantly more time lying curled up than the control group. This change in behaviour was interpreted as a

sign of poor energy status. Adult reindeer have previously been observed lying curled up during severe frost (Sokolov, 1990). A less active behaviour is a way to conserve energy and has been observed in farmed deer and steers during cold weather (Gilbert & Bateman, 1983; Redbo *et al.*, 1996).

As the reindeer recovered from the period of insufficient feed intake and adapted to their new diets, their behaviour became more similar to the behaviour of the control group, that had remained stable throughout the experiment. It is generally known that it takes about three weeks for a ruminant to adapt to a new diet. During the last weeks of feeding, the compositions of the diets were reflected in the reindeers' behaviour. The groups offered the lichen based diet had higher frequencies of intake of feed or water and less recordings of lying doing nothing else than the groups offered the pellets based diets. The higher nutrient content of the pellets may have required less eating time.

The few recordings in the category "other" indicated that the ethogram represented the different behaviours performed by the animals in this experiment. However, the health problems that occurred during the initial phase of the feeding period, especially in the group initially fed only silage (Nilsson *et al.*, 2000; Åhman *et al.*, 2002) were not reflected in the behavioural observations. Studies of the behaviour of individual animals should be a more suitable method to find individuals with problems adapting, but difficult to apply in practice.

The next step is to further complement the results from this study by analysing data of the heart rate monitor devices (Eloranta *et al.*, 2002) used on some of the animals in this experiment. By doing this, the activity pattern over the entire 24-h periods will be available, thus improving our knowledge of the true behavioural response in reindeer. The indications from the behavioural studies complemented the results found via body weight measures and analyses of blood and rumen samples. Regular behaviour studies of the animals proved to be a useful tool to document adaptations to new feeding strategies without disturbing the animals.

Acknowledgement

Research was funded by The Swedish Council for Forestry and Agricultural Research and by the Sami Fund in Sweden. The authors wish to thank the staff at the research station at the Department of Biology, University of Oulu for their co-operation in the management of the animals throughout the experiment.

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Manuscript accepted 29 March, 2004

Abstract in Swedish/Sammanfattning:

Syftet med studien var att undersöka om, och i så fall hur renars beteende påverkades av otillräckligt näringsintag och vid anpassning till olika utfodringsstrategier. Aktivitetsmönstret hos 61 inhägnade åtta månader gamla honrenkalvar studerades under 20 av totalt 42 försöksdagar. De vanligaste beteendekategorierna genom hela försöket var ligga, idissla, intag av foder och vatten samt stå passivt. Endast ett fåtal observationer av aggressivt beteende och snöätande registrerades. En begränsad giva dvs. halva mängden av fodergivan

vid fri tillgång av en lavbaserad diet påverkade djuren ätbeteende. Dessutom observerades fler djur stå passivt medan färre låg jämfört med kontrollgruppen. Under första fasen av utfodring efter restriktionsperioden låg fler djur låg ihoprullade (med mulen tätt intill bakbenet) jämfört med kontrollgruppen, vilket tolkades som ett tecken på energibrist. Beteendestudierna visade sig vara ett värdefullt komplement till övriga mätningar och provtagningar vid studier av renars anpassning till olika utfodringsregimer.