Pål Vegar Storeheier (b. 1972) successfully defended his dissertation *"Food intake and forage utilisation in reindeer during winter"* for the degree *Doctor Scientiarum* at the University of Tromsø, Norway on the 10th of October 2003. Opponents were Professor Kjell Holtenius (Swedish University of Agricultural Sciences), Professor Knut Hove (the Agricultural University of Norway) and Professor Arnoldus Schytte Blix (University of Tromsø). Professor Svein Disch Mathiesen (Norwegian School of Veterinary Science) and Dr. Monica Alterskjær Sundset (University of Tromsø) have been supervisors for the thesis.

Pål Vegar Storeheier completed his *Candidatus Scientiarum* in zoophysiology (water balance of harp seals) at the Department of Arctic Biology, University of Tromsø in 1997. He started his doctoral work in 1998 at the same Department and is currently general manager at the Centre for Research in the Elderly in Tromsø.

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Summary: The doctoral thesis of Storeheier focuses on the adaptation of reindeer to reduced availability and quality of forage in winter with special reference to diet selection, forage quality, food intake, forage digestibility and ruminal absorption of nutrients. In accordance with previous studies, Storeheier's thesis demonstrates that reindeer in northern Norway eat a combination of lichens and vascular plants (*e.g.* shrubs and graminoids) in winter. The nutrient composition and *in vitro* digestibility of terrestrial lichens eaten by reindeer in winter varied considerably between species and genera. *Cladonia arbuscula*, *Cetraria nivalis* and *C. islandica* were highly digestible (70-77%), *Stereocaulon paschale* was poorly digestible (44%), whereas *Cladonia stellaris* and *C. gracilis* had an intermediate digestibility (56-58%). Reindeer that included lichens in their diet digested *Cladonia stellaris* significantly better than reindeer that had been eating a lichen-free diet, which underlines the importance of ruminal microbial adaptations to a particular diet. Evidently, the extent to which reindeer are able to utilize lichens depends on which species that are selected and on what the animals have been eating recently. Vascular plants eaten by reindeer in winter contained more nitrogen and minerals than lichens. Especially wintergreen parts of graminoids were nutritious, being easily digested in reindeer and rich in both nitrogen and minerals. Previous studies have shown that lichens are deficient in nitrogen and minerals, and the existence of nitrogen- and mineral-rich vascular plants eaten by reindeer in winter thus indicate that these may play an important role in the nitrogen- and mineral balance of reindeer during winter. It is, therefore, suggested that eating a combination of lichens and vascular plants is an important strategy to meet the overall nutritional and metabolic needs of reindeer in winter.

The dry matter intake (DMI) of captive reindeer calves fed *ad lib.* pelleted reindeer feed (RF-80) was higher in summer than in winter, which reflects their seasonal cycle in appetite. DMI was also estimated in free-ranging reindeer calves on winter pasture in northern Norway and their DMI was 34-61 g $DM \cdot day^{-1} \cdot kg^{-0.75}$. This is only about half the DMI previously estimated in similarly sized free-ranging reindeer calves at summer pasture, and indicates that the seasonal cycle in DMI in captive animals also is expressed in free-ranging animals.

The ruminal papillae were more developed in reindeer on natural summer pasture than in reindeer on winter pasture. Seasonal changes in the level of DMI had minor effect on the ruminal papillation of captive reindeer and it is therefore suggested that the increased ruminal papillation in reindeer on summer pasture was caused by differences in the nutrient composition between the summer and winter diet.

Previous studies have shown that ruminants derive approximately 70% of their energy from short chain fatty acids produced by microbial fermentation in their reticulorumen and distal fermentation chamber. The present study indicated that the transport of both butyrate and Na^+ across ruminal epithelium in reindeer mainly is transcellular and that the transport of the two substances is interacting. Apical Na^+/H^+ exchangers were demonstrated in the ruminal epithelium of reindeer, but no evidence was found to support the existence of unique ruminal transport mechanisms in reindeer. A feed-induced increase from summer to winter in the cellular transport capacity of both butyrate and Na^+ was demonstrated in the rumen of free-ranging reindeer. This increased transport capacity was probably not caused by seasonal changes in DMI, but was attributed to seasonal changes in forage quality.

The thesis is based on the following papers:

Storeheier, P. V., Sundset, M. A., van Oort, B. E. H. & Mathiesen, S. D. 2003. Food intake of free-ranging reindeer in winter. – *J. Agric. Sci*. 141: 93-101.

Storeheier, P. V., Sehested, J., Diernæs, L., Sundset, M. A. & Mathiesen, S. D. 2003. Effects of seasonal changes in food quality and food intake on the transport of sodium and butyrate across ruminal epithelium of reindeer. – *J. Comp. Physiol. B*. 173: 391-399.

Storeheier, P. V., Mathiesen, S. D., Tyler, N. J. C., Schjelderup, I. & Olsen, M. A. 2002. Utilization of nitrogen- and mineral-rich vascular forage plants by reindeer in winter. – *J. Agric. Sci*. 139: 151-160.

Storeheier, P. V., Mathiesen, S. D., Tyler, N. J. C., Schjelderup, I. & Olsen, M. A. 2002. Nutritive value of terricolous lichens for reindeer in winter. – *The Lichenologist* 34: 247-257.

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