

Expanded abstract

The effect of the diet on the digestive organ size of reindeer

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The development of the digestive tract of ruminants is known to depend closely on the physical form of the diet, but the evolution of the digestive tract in the reindeer calf has been poorly studied. The absolute and relative sizes of the stomachs of a young ruminant can be markedly affected by the amount and nature of the solid food eaten, and this effect is independent of the age and weight of the animal (Hodgson, 1971). Also the caecocolic volume can be adjusted like that of the rumen in response to variations in food quality and availability (Hofmann, 1984).

Our objective was to determine the development of digestive tract in reindeer calves maintained on natural pasture or fed with concentrates until six months of age.

The digestive tracts of 49 reindeer calves were examined at slaughter in December 1988. Altogether 37 calves were grazing on mountain hill pasture from birth until the slaughter (6 months). Six calves grazed on mountain hill range from birth until 3.5 months of age and 2.5 months prior the slaughter they were maintained on an *ad libitum* diet of concentrates (partly concentrate fed reindeer). Six calves were fed concentrates *ad libitum* without access to pasture from birth until the slaughter (6 months) (all concentrate fed reindeer). All cal-

ves followed their mothers during the experiment. The concentrate ration was based on rapeseed meal (25% of fresh weight), cereals (21%) and grass meal (25%). The concentrates contained 20.7% crude protein and 13.9% crude fibre in the dry matter.

The reindeer were weighed to the nearest 0.5 kg with a spring scale before the slaughter. After killing the digestive organs were removed, each section of the alimentary tract was separated and weighed to the nearest 0.5 g with contents. After emptying and cleaning the organ tissues carefully the empty tissue weight of each digestive organ was determined. The small intestines and colons were weighed with contents.

The natural summer food of reindeer contains about 15% crude protein and 22% crude fibre in dry matter (Nieminen and Heiskari, 1989). Because of more nutritious food and better feed availability the all concentrate fed reindeer gained more body weight during summer and autumn and were significantly ($P < 0.001$) heavier than the freely grazing and the partly concentrate fed reindeer at slaughter. The absolute weights of the digestive organs with contents, except small intestine and caecum, were also heavier in the all concentrate fed reindeer, but only the reticulo-rumen and abomasum were significantly heavier (Table 1). In spite of

Table 1. Fresh weights with contents of regions (g, $\bar{x} \pm$ S. E.) of gastrointestinal tract in reindeer calves fed three different diets.

Group	Freely grazing	Partly concentrates	All concentrates
Body weight (kg)	44.5 \pm 0.6	44.8 \pm 0.9	53.5 \pm 2.3
n	37	6	6
Reticulo-rumen	7 530 \pm 179 ^a	6 000 \pm 539 ^b	8 083 \pm 237 ^a
Omasum	146.7 \pm 6.8	158.7 \pm 7.2	172.8 \pm 10.8
Abomasum	275.8 \pm 9.8 ^a	330.7 \pm 20.0 ^{ab}	418.5 \pm 67.2 ^b
Small intestine	845.0 \pm 27.8	1 006 \pm 33	891.8 \pm 60.1
Caecum	532.2 \pm 18.2 ^a	437.3 \pm 21.2 ^{ab}	323.1 \pm 55.0 ^b
Large intestine	368.7 \pm 14.0	413.7 \pm 21.2	420.1 \pm 15.2

a, b) Values in the same row with different superscripts are significantly different ($P < 0.01$).

Table 2. Proportions of regions (% $\bar{x} \pm$ S.E.) of total gastro-intestinal weight in reindeer calves fed three different diets.

Group	Freely grazing	Partly concentrates	All concentrates
Body weight (kg)	44.5 \pm 0.6	44.8 \pm 0.9	53.5 \pm 2.3
n	37	6	6
Reticulo-rumen	74.7 \pm 0.5 ^a	68.0 \pm 2.0 ^b	74.6 \pm 2.0 ^a
Omasum	1.5 \pm 0.1	1.9 \pm 0.2	1.6 \pm 0.1
Abomasum	2.8 \pm 0.1 ^a	3.9 \pm 0.4 ^b	3.8 \pm 0.4 ^b
Small intestine	8.4 \pm 0.2 ^a	11.7 \pm 0.9 ^b	8.2 \pm 0.3 ^a
Caecum	5.3 \pm 0.2 ^a	5.0 \pm 0.2 ^a	2.9 \pm 0.3 ^b
Large intestine	3.7 \pm 0.1 ^a	4.8 \pm 0.4 ^b	3.9 \pm 0.1 ^a

a, b) Values in the same row with different superscripts are significantly different ($P < 0.01$).

lighter body weight the freely grazing reindeer had heavier ($P < 0.001$) absolute weight of caecum with contents than the all concentrate fed reindeer (Table 1).

The relative weights of the segments in the digestive tract differed between the groups (Table 2). The absolute and relative weights of the rumen tissues were heaviest in the freely grazing reindeer and those of the abomasums were heaviest in the all concentrate fed reindeer.

The relative weights of fresh stomach contents of the partly concentrate fed reindeer differed from the other groups. The freely grazing reindeer has larger rumen and smaller omasum and abomasum in relation to live weight than earlier determined in domestic sheep (Harfoot, 1981).

The diet affected both the absolute and relative sizes of the digestive organs in the reindeer calves at the age of six months. Long and short term feeding with concentrates reduced rumen

tissue and increased reticulum and abomasum tissue in reindeer. The development of caecum regressed with long term feeding of concentrates.

References

- Harfoot, C. G. 1981. Anatomy, physiology and microbiology of the ruminant digestive tract. - In: Christie, W. W. (Ed.). *Lipid metabolism in ruminant animals*. Pergamon Press, Oxford, England. 1-19.
- Hofmann, R. R. 1984. Comparative anatomical studies imply adaptive variations of ruminant digestive physiology. - *Canadian Journal of Animal Science* 64 (Suppl.): 203-204.
- Nieminen, M. & Heiskari, U. 1989. Diet of freely grazing and captive reindeer during summer and winter. - *Rangifer* 9 (1): 17-34.

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