COMPOSITION AND QUALITY OF REINDEER (*RANGIFER TARANDUS TARANDUS* L) CARCASSES

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Background
Improved meat production in the reindeer herd is an important subject in today's Swedish reindeer industry. The production can be increased by: a) balancing the herd size to the pasture resources, and b) optimising the herd structure towards a high proportion of high-producing animals. The productivity of the herd is closely correlated to the physical condition of the animals (Danell, 1998). The herd structure can be influenced by different slaughter strategies, where an increased percentage of calf slaughter is a commonly used method to increase the meat production from the herd (Helle & Kojola, 1993; Danell, 1998). This method has been used in Finnish reindeer herds since the beginning of the 1970's and a large percentage of calf slaughter is today totally dominating the slaughter statistics (Nieminen *et al.*, 1998). To fully evaluate the effect of a changed production model including reindeer in better physical condition (higher live weights) and an increasing amount of calf slaughter, it is necessary to assess the impact on carcass weights, grading results, carcass composition and percentage of valuable cuts produced as well as meat quality. This information will provide a basis for further economical analyses.

Objectives
The purpose of the present preliminary study was to compare carcass composition and quality of reindeer calves with reindeer bulls and cows. Further studies of carcass quality will be carried out on reindeer calves in varying physical condition where an evaluation of the sensory quality of the meat will also be included.

Methods
A total of 48 reindeer were included in the study (21 bulls, 15 cows and 12 calves). All reindeer were slaughtered at the commercial slaughter plant Arctic Deli AB, Harads, Sweden. At slaughter the animals were stunned with a captive bolt. The carcasses were collected over the whole slaughter season, i.e. from September to February to represent the normal time of slaughter for various categories and the seasonal variation in quality. Before cutting, all carcasses were weighed and graded for body conformation and fat content according to the EUROP grading system used in Sweden. The cutting was performed as a dissection following an instruction developed especially for this study but based on earlier work for beef, lamb, pig, fallow deer and moose carcasses (i.e. Hansson & Malmfors, 1978; Hansson, 1997). Definition of the cuts presented in Table 1 is as follows: leg (major part of the hind-quarter of the carcass without shank, including the big muscles *M. gluteus medius, M. quadriceps femoris, M. biceps femoris, M. semitendinosus* and *M. semimembranosus*), saddle (*M. longissimus* with bone), striploin (*M. longissimus*), topside (*M. semimembranosus*) and shoulder (*M. triceps brachii, M. supra spinatus* and *M. infra spinatus*).

Statistical anlayses
The statistical analyses were carried out according to the Statistical Analysis System (SAS Institute Inc., 1997) using the GLM procedure.

Results and discussion
The best carcasses in the present study came from reindeer bulls slaughtered in September before the rut. These carcasses had significantly higher weights, grading and fat scores compared with carcasses from cows and calves (Table 1).

The reindeer is a seasonal animal and, like other Nordic cervides, is known to have a low capacity to gain weight during winter vis-á-vis summer (White & Fancy, 1986). It was still possible for reindeer calves to gain between 0.1 and 0.2 kg live weight (0.05-0.10 kg carcass weight) per day when fed mainly commercial reindeer feed (Nilsson *et al.*, 1996). A strong positive correlation has been found between good physical condition of the reindeer and shelf life of the meat, measured as ultimate pH and glycogen content in the meat (Wiklund *et al.*, 1995, 1996). These studies also concluded that there was a positive effect of good physical condition on stress resistance in the animals. When various animal categories were compared, it was shown that reindeer calves had significantly higher ultimate pH values than adult reindeer bulls and cows (Wiklund *et al.*, 1995), which also means an increased risk for decreased shelf life of the meat from calves. In the mentioned study, the average carcass weight and grading score respectively for calf carcasses (n=672) were 19.0 kg and P+, i.e. low carcass weights and poor grading scores. Rydberg (1990) found a large variation in lean meat, fat and bone content in reindeer carcasses from calves and adult reindeer, but also a significant individual variation probably related to a non-specific boning procedure.

At SLU (Swedish University of Agricultural Sciences) several studies have been carried out to develop a basis for payment systems for pig, beef and lamb carcasses in Sweden (Hansson, 1991; Malmfors, 1992: Hansson, 1997). Evaluations of carcass quality in moose and fallow deer have also been performed (Hansson & Malmfors, 1978; Gripsborn, 1994). In these studies it was concluded that a correctly performed grading of the carcasses gave information to optimise the quality of the slaughter animals as well as create an opportunity to relate payment to the actual value of the carcasses.

In the present study the seasonal variation in reindeer carcass quality was clearly demonstrated, which is in good agreement with studies performed on red deer (*Cervus elaphus*) where it was concluded that the pattern of spring/summer growth and a relative lack of growth in autumn/winter was common for all environments (Drew, 1985). In comparison with other deer species (red deer and fallow deer (*Dama dama*)) as well as other domestic species the reindeer carcasses in the present study had lower fat content and higher bone content (Drew, 1985; 1992).

Table 1. Carcass characteristics and composition (least-squares means ± standard errors) in reindeer bulls, cows and calves included in the study

Trait	Bulls (n=21)	Cows (n=15)	Calves (n=12)	Degree of sign.[1]
Carcass weight (Cw), kg	42.4^{a}±1.8	27.6^{b}±2.1	19.6^{c}±2.2	***
EUROP conformation[2]	6.4^{a}±0.4	3.4^{b}±0.4	4.4^{b}±0.5	***
Trim fat, EUROP	6.4^{a}±0.5	3.0^{b}±0.6	3.3^{b}±0.6	***
Leg, kg	14.9^{a}±0.6	9.4^{b}±0.7	7.7^{b}±0.8	***
Leg, % of Cw	32.1^{a}±1.8	34.5^{ab}±2.1	39.4^{b}±2. 2	*
Saddle, kg	8.2^{a}±0.4	5.3^{b}±0.4	4.0^{c}±0.4	***
Saddle, % of Cw	16.8±1.2	19.2±1.3	20.3±1.4	n.s.
Striploin , kg	1.5±0.2	1.4±0.2	0.9±0.2	n.s.
Striploin, % of Cw	9.4±2.2	5.0±2.6	4.8±2.8	n.s.
Topside, kg	3.2^{a}±0.4	1.5^{b}±0.5	1.3^{b}±0.5	**
Topside, % of Cw	5.8^{ab}±0.2	5.4^{a}±0.3	6.6^{b}±0.3	*
Shoulder, kg	10.9^{a}±1.3	5.5^{b}±1.5	3.8^{b}±1.6	**
Shoulder, % ofCw	17.3±0.9	19.9±1.0	19.5±1.0	n.s.
Bone, kg	8.1^{a}±0.7	7.8^{a}±0.8	4.9^{b}±0.9	*
Bone, % of Cw	18.7^{a}±1.1	23.2^{b}±1.3	25.1^{b}±1.4	**
Fat, kg	4.7±1.9	2.6±2.1	0.01±2.3	n.s.
Fat, % of Cw	6.5±2.0	1.9±2.3	0.06±2.5	n.s.

[1] n.s. = p>0.05; * = p≤0.05; ** = p≤0.01; *** = p≤0.001. Means in the same row having the same superscript are not significantly different (p>0.05).

[2] The EUROP system used in Sweden:

E	U	R+	R	R-	O+	O	O-	P+	P	PK
14	11	9	8	7	6	5	4	3	2	1

Further studies within this project will focus on the relationship between carcass composition and EUROP grading scores for reindeer calves in varying physical condition. Eating quality of reindeer meat from calves and adult animals will also be assessed. All together, this information will provide a basis for a full economical evaluation of a changed production model including reindeer in better physical condition (higher live weights) and an increasing amount of calf slaughter in the reindeer herd.

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