CHARACTERISTIC OF REINDEER MEAT QUALITY OBTAINED FROM TWO DIFFERENT NORWEGIAN REGIONS

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Introduction

The production of reindeer is the most important source of income for Sami people and it is an essential part of their life and culture. Reindeer husbandry is mainly based on the utilisation of native pastures, which give the reindeer necessary nutrients from the vegetation growing there. Reindeer meat produced in extensive systems has a great potential to be an attractive product for health oriented consumers on account of low fat content with high ratio of polyunsaturated fatty acids and most likely high antioxidant status. A limited amount of research has been conducted concerning quality attributes of reindeer. The objectives of the present study were to characterise chemical composition, colour and antioxidant activity of reindeer meat. In addition, the comparison of reindeer meat to beef meat was included.

Materials and Methods

Sixteen animals were used; 8 reindeers from Nord Norway (Kautokeino) and 8 reindeers from Mid Norway (Roros). Slaughtered, dressed carcasses hang in the chilling room at +2° for 4 days. Marked, vacuum packaged loin and top round muscles were put in cooled boxes and sent, refrigerated, to Matforsk AS. After 3 days at +4°C, samples were either frozen at - 40°C for proximate analysis or at -80°C for antioxidant activity. Beef loins from 8 NRF (Norwegian Red) young bulls (450kg live weight) slaughtered at a commercial slaughterhouse (HedOpp, Norway), were obtained. Minolta L*, a*, b* and pH were measured on meat cuts; proximate analysis, total phenols and antiradical power (ARP) on grinded meat. Duplicate analyses were made.

Colour measurement. An automatic Minolta Chroma Meter CR-300 with 8 mm measuring cell registered L* (lightness), a* (redness) and b*(yellowness) values at light source – D65 illuminant. The colour of loin and top round was evaluated on the basis of five measurements taken on the meat surface.

pH-measurement. Determination of pH directly in meat cuts was carried out with a Beckman 31 pH meter fitted to a combination insertion electrode Zerolyt (Mettler-Toledo AG, Switzerland)

Proximate analysis. The meat samples from reindeer were analysed by "AnalyCen" laboratory (Moss, Norway). Water, fat and protein were determined in duplicate according to routine methods, respectively NMKL 231991, EU DIR 98/64 m and EU DIR 93/28 m.

Total phenols in extracts were determined using the Folin-Ciocalteu procedure (Waterhouse, 2002). Muscle samples (5.0 g) were homogenized with 50 mL methanol (60 s, 8200 rpm) and centrifuged (20 min, 13700 rpm, 4 °C). To filtered supernatants (0.2 mL) 1.0 mL Folin-Ciocalteu's reagent (1:10 v/v, with water) and 0.8 mL Na_2CO_3 (7.5% w/v) were added. After incubation for two hours (~20°C) in dark, absorption was measured at 765 nm (Shimadzu UV160U, UV-visible spectrophotometer, Kyoto, Japan). Gallic acid was used as standard. Total phenolic content was expressed as gallic acid equivalents (GAE) in mg/100 g meat.

Antiradical power (ARP). The antioxidant activity of meat was determined by using the 2.2-diphenyl-1-picrylhydrazyl (DPPH•) according to the procedure described by Brand-Williams et al. (1995) with some modifications. DPPH• (25 mg/l) and meat samples were dissolved in absolute ethanol (AE) instead of methanol. Muscle samples (2.5 g) were homogenized with 10 mL of AE (30 s, 8200 rpm) and centrifuged (20 min, 13700 rpm,.4°C). The filtrated supernatants in three concentrations were mixed with DPPH• solution, covered and incubated in the dark, at ~20°C. The reduction of the DPPH• was measured by reading the absorbance at 515 nm on the Ultraspec 3000 (Pharmacia Biotech, Cambridge, UK) against a blank (AE and DPPH•), after 60, 90. and 120 min of incubation. The percentage of remaining DPPH• was used to calculate the amount of sample required to decrease the initial DPPH• concentration by 50% (EC50). The antiradical power (ARP) was given as the reciprocal of EC50, in units of mg of DPPH• per g meat.

Statistical Analysis. Effect of origin of reindeer, sex and muscle type on meat quality was analysed by ANOVA.

Resultater

ANOVA results (means and p – values) for carcass weight, pH and chemical composition of the reindeer meat are presented in Table 1. The carcass weight of reindeers ranged from 19.0 kg to 36.0 kg. Origin did not affect carcass weight or pH of muscles. No effect of experimental variables on carcass weight or pH was noticed while the chemical composition of reindeer meat was influenced by all of them. Reindeer meat from Kautokeino had

more water and less protein and fat than meat from Roros. Sex influenced amount of water and fat in meat. Females had more fat and less water in muscles. Protein content depended on type muscle and was higher in loin than in top round. Generally, reindeer meat was very lean (0.5 – 1.6 % fat) and protein reach (22 -25 %).

Table 1. The effect of origin, sex and muscle type on carcass weight, ultimate pH and chemical composition of reindeer meat

Variables		Carcass weight kg	Ultimate pH	Water %	Protein %	Fat %
Origin	Kautokeino	26.2	5.6	73.6	23.4	0.7
	Roros	26.6	5.6	72.6	24.2	1.0
Significance (p value)		*0.656*	*0.180*	***0.001****	***0.001***	***0.019***
Sex	Male	27.2	5.6	73.6	23.6	0.6
	Female	25.5	5.5	72.6	24.0	1.1
Significance (p value)		*0.245*	*0.078*	***0.027***	*0.293*	***0.047***
Muscle	Top round	26.3	5.6	73.3	23.6	0.8
	Loin	26.3	5.6	72.9	24.1	0.9
Significance (p value)		*1.000*	*0.728*	*0.145*	***0.026***	*0.211*

*p value < 0.05 indicates a significant effect of the tested variable

Results presented in Table 2 showed considerable differences between meat from reindeer and beef both in terms of lightness and antioxidant activity. Beef meat was significantly lighter, had lower amount of total phenols and four times lower antiradical power in comparison to reindeer meat. The origin of reindeers had a large influence on colour parameters. The lower L*, a* and b* values for Kautokeino reindeer indicated a meat with darker appearance, less red and yellow colours than meat from Roros. Besides, meat from Kautokeino had higher antiradical power and contained more total phenols than reindeer from Roros. An influence of sex on the total phenols was detected. Meat from female carcasses showed significantly higher level of total phenols than meat from male carcasses. No significant differences were found between muscles type.

Table 2. Comparison of colour attributes, antioxidant activity, and total phenols of reindeer and beef meat

Variables		Lightness L*	Redness a*	Yellowness b*	ARP mg DPPH/g meat	Total phenols mg GAE/100 g meat
Origin	Kautokeino	31.5	17.7	5.8	0.84	28.92
	Roros	33.1	19.6	7.5	0.60	27.08
Significance (p value)		***0.032****	***0.030***	***0.002***	***0.011***	*0.145*
Sex	Male	31.5	18.7	6.5	0.58	25.46
	Female	33.0	18.5	6.8	0.87	30.55
Significance (p value)		*0.230*	*0.898*	*0.791*	*0.061*	***0.020***
Muscle	Top round	32.8	18.2	6.2	0.78	28.78
	Loin	31.7	19.0	7.0	0.66	27.22
Significance (p value)		*0.230*	*0.271*	*0.101*	*0.169*	*0.212*
Beef		**40.4**	**18.4**	**5.9**	**0.17**	**18.0**

*p value < 0.05 indicates a significant effect of the tested variable

Conclusion

Reindeer meat contains a high amount of protein and low amount of fat. In comparison to beef meat, reindeer meat is rich in total phenols and has high antioxidant activity. Chemical composition, colour and antioxidant activity were largely effected by origin i.e. places the animals graze. Females accumulated more total phenols than male reindeers.

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References

Brand-Williams, W., Cuvelier, M. E., & Berset, C. (1995). Use of a free radical method to evaluate antioxidant activity. *Lebensmittel-Wissenschaft und Technologie, 28,* 25-30.

Waterhouse, A. L. Determination of total phenolics. In *Current Protocols in Food Analytical Chemistry*; R. E. Wrolstad, Ed.; John Wiley & Sons, Inc.: New York, 2002; pp I.1.1.1-I1.1.8.