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COMPOSITION AND SENSORY TRAITS OF BISON MEAT (*Bison bison*)

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OBJECTIVES

A study was undertaken to determine the quality traits of bison meat (*Bison bison)* as affected by muscle type and age, in order to compare them with meats from other domestic herbivores. Here are presented the results concerning pH, chemical composition, muscle fibre type and sensory traits. A texture evaluation is under course.

MATERIAL AND METHODS

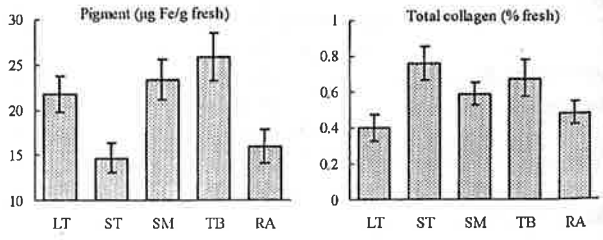
A total number of 8 bisons were reared under range conditions and slaughtered at the age of 2.5 (n = 3), 3.5 (n = 3), 7 (n = 1) and 13 (n = 1) years. Carcass quality was evaluated (dressing %, anatomical composition). Values of pH were recorded at regular time intervals from 1 to 72 h post-mortem in the Longissimus thoracis (LT), Semitendinosus (ST) and Triceps brachii (TB) muscles. The contents in dry matter, pigment (heme iron), total collagen (hydroxyproline), soluble collagen (90°C/2 h) and total lipids were determined in the LT, ST, TB, Semimembranosus (SM) and Rectus abdominis (RA) muscles of the 2.5- and 3.5-year old bisons. Isometric tension during a heating process at a constant rate (3°C/min) was measured on samples of connective tissue isolated from the epimysium of the Diaphragma muscle. The type of muscle fibres was determined in muscles LD, ST and TB of the 2.5- and 3.5-year old bisons. Myosin heavy chain (MHC) isoforms were separated according to their molecular weight by polyacrylamide gradient gel electrophoresis (5-10 %) and compared with their homologues from the same muscles of 2-year old male bovine. The Cutaneus trunci (CT) and Masseter (Ma) muscles were used as fast and slow control muscles respectively. The metabolic type of muscle fibres was determined by measuring the isocitrate dehydrogenase (ICDH, oxidative) and lactate dehydrogenase (LDH, glycolytic) enzyme activities. The sensory attributes of muscle LT were compared by a trained panel to those of the LT muscle of Charolais cull cows (44 to 47 months of age) after cooking to a core temperature of 55-60°C.

RESULTS AND DISCUSSION

The average live weight, hot carcass weight and dressing % of the 2.5- and 3.5-year old bisons at slaughter were respectively 425 ± 35 kg, 245 ± 22 kg and 57.2 ± 0.9 %. The average proportions of lean, fat and bone were 73 ± 3 %, 10 ± 2 % and 17 ± 1 % respectively. The muscles LT, ST and BF reached the same ultimate pH value of 5.4 within 10 h post-mortem, which prevented any occurence of DFD meat. The pH was already below 6.0 within 3-4 h post-mortem, thus indicating a relatively rapid pH fall.

The mean chemical composition of the fresh meat was: dry matter 25 ± 1 %, pigment 20 ± 5 µg Fe/g, collagen 0.58 ± 0.15 %, soluble collagen 17 ± 8 % of total collagen, and lipids 0.9 ± 0.4 %. There was little difference of dry matter and lipid contents between muscles. Large variations, however, were found in the pigment and collagen contents of the muscles that could be classified respectively as follows: ST < RA < LT< SM < TB, and LT < RA < SM < TB < ST (Figure 1). In beef, Renerre (1984) and Dumont and Bousset (1988) reported an average pigment content of 16, 13, 18, 20 and 17 µg Fe/g in the LT, ST, SM, TB and RA muscles respectively. In the same muscles and in the same order, the collagen content generally found in the litterature for beef are 0.3-0.6, 0.8-1.1, 0.7-1.0, 0.6-0.7 and 0.4-0.8 % (Boccard and Dumont, 1974; Dransfield, 1977, Kopp and Bonnet, 1982).

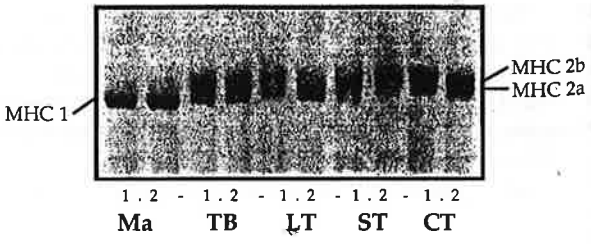
Figure 1. Pigment and collagen contents in 5 bison muscles



The lipid contents in the LT and SM muscles were lower than those found in these muscles in the bison by Marchello et al. (1989) (1.9 and 1.2 % respectively). This was probably the consequence of the low degree of fatness of the animals of the present trial. Then, the chemical composition of bison meat can be compared to that of beef of continental breeds, with the exception of lipids which concentration is lower in bison than in conventional beef. The values of collagen solubility were also comparable to those of beef under the same heating conditions (Kopp and Bonnet 1982; Berge et al., 1991; Micol et al., 1992). As in beef, the collagen of the SM muscle was the least soluble among the muscles studied.

The myosin heavy chain isoforms of bison had the same molecular weight as those of the bovine (Figure 2; Picard et al., 1994). The CT, a completely fast muscle (MHC 2a and MHC 2b) in the bovine, was also completely fast in the bison. On the contrary, the Ma muscle, a completely slow (MHC 1) muscle in the bovine, contained a majority of slow MHC, and a small proportion of fast isoforms in the bison. The ST, LT and TB muscles of the bison were constituted of the three types of isoforms. Compared to the bovine, the ST muscle contained less slow isoform (MHC 1), the LT muscle contained less MHC 2b and more MHC 2a and MHC 1 isoforms, and the TB contained less MHC 2b and more MHC 2a isoforms. The analysis of enzyme activities showed that the muscles could be classified as

Figure 2. Gel electrophoresis (SDS-PAGE) of myosin heavy chain isoform in different muscles of bovine (1) and bison (2).



follows: TB > LT > ST according to their oxidative metabolism, and ST > LT > TB according to their glycolytic metabolism (Table 1). By comparing these results with the muscle metabolism of bovine muscles, it can be concluded that bison muscles are more oxidative than those of beef.

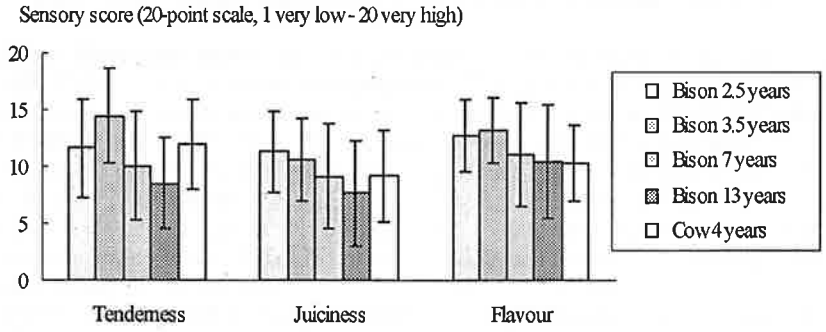
The increase in age from 2.5 to 3.5 years had little effect on meat chemical composition and collagen heat stability. The maximum isometric tension measured on the epimysial connective tissue of the 7- and 13-year old bisons was 756 and 869 respectively against 515 N/cm² at 2.5-3.5 years of age, thus showing that the heat stability of muscle collagen increases with age in the bison, as in other species (Kopp and Bonnet, 1982), and that a one-year difference in age is too small to detect this effect.

Table 1. Enzyme activities of ICDH and LDH (in nkat/g muscle) in the LT, ST and TB muscles of bison.

Age	LT		ST		TB	
(years)	ICDH	LDH	ICDH	LDH	ICDH	LDH
2.5	0.57	89	0.35	78	0.23	114
3.5	0.62	83	0.37	99	0.24	123
mean	0.59	86	0.36	89	0.24	118

The sensory analysis showed a decrease in meat tenderness as the age increased from 2.5-3.5 to 13 years (Figure 3). It may be presumed that this age-related changes in tenderness are associated with the changes observed in connective tissue heat stability. Juiciness and flavour did not differ between the ages of 2.5 and 3.5 years, but they decreased slightly at more advanced ages. The meat from the LT muscle of the youngest bisons (2.5 and 3.5 years) was scored slightly more juicy and more flavoursome than the corresponding meat from 4-year old beef cows; there was no difference in tenderness between the two types of meat. The older bisons yielded meat as tender and as juicy, but less tender, than that of beef.

Figure 3. Comparative sensory analysis of meat from bisons of different ages and cull beef cow (Longissimus muscle)



KEY WORDS

Bison, Carcass quality, Meat quality, Muscle, Composition, Myosin, Metabolic type, Connective tissue, Sensory

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