MEAT YIELD AND QUALITY:

BISON STAMPEDING BACK ONTO PRAIRIE MENUS AS THE NEW MEAT PRODUCING ANIMAL

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BIOGRAPHIC DETAILS

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Jennifer is currently enrolled in a PhD program under the supervision of Dr. Mick Price of the Department of Agricultural, Food and Nutritional Science at the University of Alberta. She is presently conducting research at the Agriculture and Agri-Food Canada Lacombe Research Centre examining the impact of various post-mortem carcass technologies on bison meat quality. She hopes to see you all in Vancouver next February where she can let you in on the results of her studies.

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Industry overview

Plains bison (*Bison bison bison*) is the primary subspecies used for commercial bison meat production in Alberta, with a captive wildlife status applied by Agriculture and Agri-Food Canada to farmed animals. According to two recent and comprehensive surveys commissioned by Alberta Agriculture Food and Rural Development, Alberta producers farmed 22,782 animals in 1996, 50.36% of the total Canadian bison herd. Alberta production statistics indicate that animal numbers are increasing, with an estimated herd growth rate of 15-20% per year to 2010; however, supply to the slaughter industry continues to fluctuate resulting in seasonal availability of product. Demand for bison meat is currently increasing faster than production rate. As a result, supply consistency has become one of the top concerns prohibiting regular inclusion of bison on menus of the 44 Alberta restaurants surveyed in 1998. Representatives of operations involved in further processing are also considering bison once value-added products and appropriate markets are identified and when animal production is able to meet export demand. It appears that all the "industry players" are poised for action, yet information about bison carcass and meat quality remains scarce.

Timely investigation

A series of studies on bison meat quality have been ongoing at the Agriculture and Agri-Food Canada Lacombe Research Centre (LRC). Control data were pooled from a set of experiments involving 39, 2-3 year old bison bulls with a mean liveweight of 472.5 kg. All animals were feedlot finished at commercial operations in Alberta before shipping to LRC for slaughter following typical bison processing methods. Carcass and meat quality assessments were completed on *Longissimus lumborum* (striploin) samples from all sides and 20 sides were subject to saleable yield dissection. Data are listed in Tables 1 and 2.

Carcass traits

In general bison carcasses tend to have a slightly lower dressing percentage (from ~56-62%) than market beef cattle probably due to the larger head and thicker hide on bison as well as the thick hair coat present on animals slaughtered during winter months. The distribution of finish on bison carcasses tends to be localized over the

shoulder and loin. This pattern of fat distribution provides less protection from evaporation for underlying lean tissue, and results in a tendency for bison carcasses to lose more weight during conventional chilling as compared to beef carcasses that bear a more evenly distributed subcutaneous fat cover.

All Canada A1, A2, A3, B1, and B2 bison grades indicate a youthful carcass based on subjective evaluation of the degree of ossification of the cartilaginous caps of the 9th-11th thoracic vertebrae. With the exception of B2, these grades differ only in fat thickness requirement. The Canada B2 grade is assigned where at least one of muscling, fat colour, or lean colour was less than optimum. The Canada C1 grade is assigned where the carcass was described as being of intermediate maturity. Canada D1 is a catch-all classification for various defects in lean and/or fat. The presence of the miscellaneous D grade category and the lack of specific defect information for individual carcasses demonstrate a weakness of the current grading system. The current carcass grading system is designed to fault carcasses for excessive ossification at an anatomical point that can be easily altered by inaccurate carcass splitting, and for lack of fat cover. Based on marketing schemes being used by some bison meat companies to guarantee "quality", more than 30% of the carcasses in the current study would have been ineligible for marketing except as a ground-type, low-value product because of failure to meet A grade fat thickness standards.

There are alternatives to this type of unfortunate product devaluation. The implementation of a branded product marketing system for bison would be an ideal method for avoiding the limitations of the current Canadian bison grading system, and for creatively marketing unique products of an ensured quality. The use of alternative postmortem treatments such as electrical stimulation, altered suspension, or modified chilling can be employed to increase the level and consistency of meat tenderness from lean carcasses. Because the bison meat industry is free from long-standing traditions and consumer habits, it presents an ideal opportunity for a custom designed processing and marketing plan.

Carcass yield

Saleable yield (weight of saleable meat, trimmed to retail specifications, and calculated as a percent of cold carcass weight) of bison carcasses tended to be slightly greater than that from comparable beef carcasses with less fat trim in all cuts except those in areas of localized subcutaneous fat cover. The greatest disparity between bison and beef appeared in the forequarter cuts, particularly the blade eye that, for bison carcasses, included the hump. Because of the large dorsal spinous processes, bison carcasses have more meat in the shoulder region than beef. The exaggerated size of the forequarter can create the appearance of a disproportionately small hindquarter, but there is a minimal difference between bison and beef hindquarter cuts.

Meat quality traits

Interpretation of objective colour values indicated that at the time of carcass grading bison meat was darker, more purple red, and had a greater colour intensity than comparable beef samples. The tendency for bison meat to appear quite dark is not, however, an indication of DFD, a phenomenon apparently not common amongst bison carcasses. Given that ultimate pH was within the normal range for red meat, the typically dark colour may indicate a greater myoglobin concentration in bison meat.

Not surprisingly, bison carcasses with less overall fat cover tended to cool more rapidly than conventionally chilled beef carcasses. Average sarcomere length from bison *Longissimus lumborum* was relatively short. It may be that post-slaughter carcass chilling carried out in a manner similar to beef may not be appropriate for leaner bison carcasses, and may routinely result in cold shortening. Shear values at 6, 13, and 20 days postmortem demonstrated an improvement in tenderness with increased ageing time. Within

each sampling period, however, a wide range in shear values was observed, suggesting that unless postmortem carcass treatment is appropriate for the lean carcass type, variability of bison meat tenderness could become a consumer issue.

Moisture content and crude protein level of bison *Longissimus lumborum* was very similar to values previously reported for both bison and Canada A1 beef. Research using US Choice grade beef, similar to Canada AA-AAA available in Canadian grocery stores, has indicated a crude fat content of 7.4%, while bison contained 1.6%. Bison is commonly marketed with emphasis placed on nutritional qualities to target the health conscious population. The data indicate that bison muscle is lower in fat than beef, thus for consumers seeking an additional or alternative meat source, bison may be attractive.

The quick picture

The bison in this study produced lean carcasses

Table 1: Bison carcass characteristics and *Longissimus lumborum* quality traits

		Mean	SEM
Liveweight kg		472.5	4.7
Hot weight kg		279.2	3.9
Dressing percentage %		59.1	0.4
Cold weight kg		274.6	3.7
Cooler shrink g·kg^{-1}		16.0	1.0
Drip loss mg·g^{-1}		23.05	1.70
Shear kg	6 d	9.55	0.70
	13 d	7.91	0.75
	20 d	6.52	0.54
Sarcomere length µm		1.57	0.05
pH 24 h		5.64	0.03
pH 6 d		5.54	0.02
Colour	L* 24 h	30.88	0.39
	Hue$_{ab}$ 24 h	23.51	0.33
	Chroma$_{ab}$ 24 h	21.85	0.60
	L* 6 d	32.11	0.31
	Hue$_{ab}$ 6d	22.57	0.43
	Chroma$_{ab}$ 6 d	22.83	0.54
Proximate analysis	Moisture mg·g^{-1}	748.9	1.9
	Fat mg·g^{-1} WMB	16.1	1.5
	Protein mg·g^{-1} WMB	216.4	2.2

with comparable moisture and protein contents and less fat than a comparable group of beef carcasses. The bison carcasses had a greater yield of marketable meat than beef carcasses, with the "extra" product located in the forequarter. Bison meat tended to be dark, purplish-red. Tenderness was variable, a problem that may be solved with the routine use of postmortem carcass handling techniques designed to influence meat quality in order to produce a consistent product. Implementation of this type of processing would assist with the production and marketing of branded products. Production of bison as a meat producing animal is an expanding industry in Alberta, with growing support for the finished product. Availability of basic information about bison carcass and meat quality will support creative meat processing and marketing techniques and will enhance receptivity of consumers to this alternative meat product.

Table 2: Comparison of bison and beef cuts (% side weight) and saleable yield

	Bison			Beef	
	Mean	**SEM**	**Index****	**Mean**	**SEM**
Forequarter weights kg	45.15	0.33			
Blade eye (hump)	9.42	0.34	250	3.77	0.03
Short cut clod	4.97	0.11	127	3.92	0.02
Chuck tender	1.27	0.02	157	0.81	0.01
Neck	3.08	0.10	102	3.02	0.03
Shoulder	2.22	0.13	119	1.87	0.03
Brisket point	2.33	0.06	88	2.64	0.03
Short ribs	2.46	0.07	262	0.94	0.01
Inside skirt (front)	0.45	0.01	98	0.46	0.01
Foreshank	1.82	0.02	113	1.61	0.01
Forequarter saleable yield kg	63.73	1.26			
Hindquarter weights kg	32.81	0.31			
Inside round	6.74	0.10	119	5.67	0.04
Sirloin tip	3.64	0.06	124	2.93	0.02
Striploin	3.20	0.05	102	3.13	0.02
Top butt	3.23	0.06	100	3.22	0.02
Tenderloin	2.07	0.04	137	1.51	0.01
Flank steak	0.52	0.01	104	0.50	0.00
Hindquarter saleable yield kg	46.33	1.03			
Saleable yield %	77.96	0.41	110	71.15	0.19

*Canada A1, A2, A3 beef data provided by W. Robertson, Lacombe Research Centre
Index = (beef mean/bison mean) x 100 **(Beef = 100)