NUTRIENT COMPOSITION OF FED BISON

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Background

Dramatic changes are occurring in the food industry. The bison industry is one of the fastest growing alternative agriculture enterprises, and an increase of 25% every year until 2005 is expected (Willyard, 1997). The demand for live bison being raised for meat production already exceeds supply. Currently published data, based mainly on the loin eye muscle, indicates bison is a highly nutrient-dense food (Marchello et al., 1989, Anderson, 1989). The goal of this project was to develop an adequate data base on the nutrient composition of the North American bison that represents the current type of fed bison and bison cuts being marketed through restaurants and supermarkets.

Materials and Methods

Individual cuts from the top round, top sirloin, ribeye and shoulder clod were analyzed from 100 fed bison representing various geographic areas of the United States (nine states) and Canada (three provinces). All animals were males approximately 25 mo old fed hay free choice and a concentrate portion on a daily basis. The mineral/vitamin mix was usually mixed with the concentrate portion of the ration but was also available free choice. Meat samples were frozen and shipped to North Dakota State University. All subcutaneous fat was removed prior to lyophilization and homogenization. Samples were stored at -20 C for later chemical analysis. All samples were determined by AOAC or other accepted procedures for the various nutrient parameters studied. Tukey's multiple range test was used to determine statistical significance between nutrient concentrations of the four muscles analyzed (Sokol and Rohlf, 1995).

Results

When one compares the various parts of the carcass one observes differences in the various components (Table 1). Moisture ranged from a low of 74% in the ribeye to 75.4% in the clod muscle. Protein varied from a low of 21% in the clod to a high of 22.3% in the round. The round also had the least amount of fat, with 1.6% while the sirloin and the ribeye contained 2.4%. Cholesterol content varied from 61mg/g in the ribeye to 71mg/g in the sirloin.

In many instances the mineral concentration varied among the four muscle groups studied. However, these differences though statistical are minimal compared to the Recommended Dietary Allowance (RDA) for these nutrients (FNB/NRC, 1989). Ranging from 4.1mg/100g in the clod muscle to 5.9mg/100g in the ribeye, bison would not contribute significantly to the RDA (800mg/d) for male and females over the age of 24. However, bison is an excellent source of Fe, containing around 3mg/100g in the various muscles analyzed. Bison is low in Na ranging from 48 to 60 mg/100g in the ribeye and clod muscles, respectively. It is noteworthy that even though the Se content is only .03mg/100g it can spare some of the vit E and will provide 36.4% of the RDA for men. The rest of the minerals appear to be in adequate amounts for nutritional needs in humans.
No differences were observed among the various muscles examined for vitamins with the exception of vitamin A and B-6. Vitamin A averaged .00079mg/100g, with a range of .00064 in the clod to .00094 in the sirloin. No vitamin C was detected. With the exception of vit B-12 none of the other vitamins are present in quantities of importance from a nutritional point of view. However, vit B-12 would provide 35% of the RDA form 100g of raw bison. Percentages of fatty acids for the four muscles are given in Table 2. The statistical differences were inconsequential and usually made up less than 2% with the exception of oleic acid where the round had 5% more than the ribeye. The ratio of palmitic to stearic acid was 1 to 1 and the balance of the saturated to monounsaturated to polyunsaturated acids was 50%, 37%, 9%, respectively. The round had the greatest amount of saturated fat (52%) and polyunsaturated fat (9%) and the least amount of monounsaturated fat (34%) compared to the other muscles studied. The combination of fatty acids adds to the unique flavor and appetite appeal of bison.

Conclusions

Differences in nutrient composition of bison can be attributed to many factors, such as age, feed, function of the individual muscle and condition of the animal when harvested. This data represents what is currently being marketed in North American and confirms that bison meat is a highly nutrient-dense food because of the proportion of protein, fat, minerals and vitamins in relation to its caloric content.

Selected Literature Cited

Anderson, B.A., 1989. Composition of Foods, USDA Handbook No. 8-17. U.S. Department of Agriculture, Washington, DC.
AOAC. 1990. Official Methods of Analysis, 15th ed. Association of Official Analytical Chemists, Washington, DC.
FNB/NRC. 1989. Recommended dietary allowance, 10th ed. National Academy of Science, Washington, DC.
Marchello, M.J., D.B. Milne, A.G. Fischer, and P.T. Berg. 1989. Nutrient composition of raw and cooked Bison bison. J. Food Comp. 2:177.
Sokal, R.R. and F.J. Rohlf. 1995. BIOMETRY. The principle and practices of statistics in biological research (3rd ed) W.H. Freeman and Co., New York.
Willyard, B. 1997. Personal communication. President, ND Buffalo Assoc.

Table 1. Nutrient composition of raw separable lean of Bison cuts

Nutrient	Ribeye	Sirloin	Top Round	Clod
Protein (%)	22.091a	21.378b	22.293a	21.054c
Moisture (%)	74.027c	74.388bc	74.623b	75.396a
Fat (%)	2.417a	2.443a	1.620b	2.141a
Ash (%)	1.196b	1.192b	1.224a	1.163c
Cholesterol (mg/100 g)	61.554c	70.815a	66.028b	66.433b
Energy (kcal/100 g)	145.707a	145.132a	141.497ab	138.057b
	(mg/100 g on a wet weight basis)			
Calcium	5.884a	5.114ab	4.642bc	4.086c
Copper	0.119c	0.149a	0.129bc	0.143ab
Iron	2.781b	3.070a	2.961a	3.044a
Magnesium	24.050b	24.424ab	24.703a	23.217c
Manganese	0.013b	0.015a	0.013ab	0.014ab
Phosphorous	199.022a	202.871a	203.371a	188.023b
Zinc	3.202c	3.447bc	3.613b	4.948a
Sodium	47.985c	51.619b	52.706b	60.367a
Potassium	347.541a	335.570a	345.181a	319.556b
Selenium	0.023	0.025	0.027	0.026
Vitamin A	0.0008b	0.0009a	0.0008b	0.0007c
Alpha Tocopherol	0.039	0.051	0.052	0.046
Gamma Tocopherol	0.012	0.012	0.014	0.014
Vitamin B-6	0.252ab	0.259ab	0.281a	0.221b
Thiamin	0.046	0.045	0.048	0.042
Vitamin B-12 (mcg/100 g)	2.175	2.253	1.901	2.196

abc Mean within a row followed by different letters differ significantly (P<0.05).

Table 2. Fatty acid composition of raw separable lean for Bison cuts

Fatty Acids	Percentage			
	Ribeye	Sirloin	Top Round	Clod
Me. Myristic (14:0)	1.083a	1.026a	0.986ab	0.912b
Me. Myristoleate (14:1)	0.348	0.302	0.377	0.358
Me. Pentadecanoate (15:0)	1.880c	1.887c	2.519a	2.204b
Me. Palmitate (16:0)	14.251a	13.551b	13.179bc	12.663c
Me. Palmitoleate (16:1)	1.928ab	2.031a	1.771b	1.971a
Me. Margarate (17:0)	1.150a	1.064ab	0.995b	1.046ab
Me. Stearate (18:0)	15.511a	15.654a	14.622b	14.616b
Me. Oleic (18:1)	36.304a	35.972a	31.741b	35.255a
Me. Linoleic (18:2)	7.030c	8.138b	9.239a	9.174a
Me. Linolenate (18:3)	0.737	0.606	0.759	0.677
Internal Standard (19:0)	14.449b	13.232b	17.165a	14.155b
Me. Eicosenoate (20:1)	0.535	0.499	0.569	0.503
Me. Behenate (22:0)	2.258c	2.688bc	3.257a	2.875ab
Me. Erucate (22:1)	2.519	2.858	3.237	3.245
Saturated	49.704b	48.239c	51.605a	47.535c
Monounsaturated	39.307a	39.107a	34.600b	38.480a
Polyunsaturated	7.428c	8.526b	9.649a	9.601a

abc Mean within a row followed by different letters differ significantly (P<0.05).