MACRO AND MICRO MINERAL CONTENT OF VENISON AND BEEF FARMED IN NEW ZEALAND

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***Abstract* - Differences in animal farm management practices can impact on the nutritional quality of the meat produced. Mineral analysis was observed for venison and beef farmed in New Zealand. Venison had higher concentration of magnesium, phosphorus, copper, iron, manganese and lower concentration of calcium, zinc, aluminum, cadmium and lead compared to beef. Both meats contained a good amount of essential minerals for good health, but venison appears to be a much healthier alternative to beef due to its concentration of the minerals observed.**

Index terms: **beef, mineral, venison.**

Introduction

Red meat is normally marketed as a good source of protein, and a rich source of essential minerals such as iron (especially the heme form) and zinc for the diet. Differences in farm management practices (e.g. grazing, animal drenching and the use of certain drugs to combat inherent deficiencies) can however impact on the nutritional quality of the meat produced (Dikeman, 2002). Venison is perceived to be a healthy meat choice due to its low fat content; however information on the mineral composition of venison is limited. Such information is of interest to consumers, dietitian and producers of venison. This paper compares the macro and micro element composition of beef and venison farmed in the Otago region in New Zealand.

Materials and Methods

Fresh beef (n=6) and venison (n=3) striploins were obtained from commercial abattoirs licensed for export. Samples were prepared using a ceramic knife, vacuum-sealed and stored at -80°C until analysis. Mineral analysis was carried out using an Inductively Coupled Plasma Emission Spectrometer (AXIAL Varian 720, Varian, Inc. Palo Alto, USA). The sample preparation, and mineral detection and quantification were carried out as described by Bekhit et al. (2008). A certified reference material (bovine muscle, BCR-CRM 184, Community Bureau of Reference, Geel, Belgium) was used as a reference standard and digested under the identical conditions.

Results and Discussion

Beef striploins were higher in calcium (Ca) and lower in magnesium (Mg) and phosphorus (P) compared with venison striploin ($P < 0.05$) (Table 1). Ca has several important physiological functions (skeletal development and maintenance; proper functioning of neuromuscular and cardiac function) as well as a major role in meat tenderization postmortem. Mg is an important cofactor in numerous enzyme systems and is involved in both aerobic and anaerobic energy generation and in glycolysis (Elin, 1988). No differences were observed in potassium (K), sodium (Na) and sulfur (S) concentrations between both meats. Na in both meats was at lower concentrations than previously reported (Aidoo & Haworth, 1995; Ishizuka et al., 2001). There are no known dietary requirements for S, but it is an essential part of sulfur containing amino acids (Komarnisky et al., 2003).

Table 1. Mean value and SD of macro minerals from strip loins of beef and venison

Mineral (mg/100g)	Beef	Venison
Ca*	3.90 ± 0.50	3.08 ±0.20
K	355.52 ±12.19	354.35 ±4.55
Mg*	25.03 ±0.89	28.33 ±0.87
Na	32.98 ±3.83	36.00 ±0.61
P*	193.83 ±7.13	213.85 ±6.65
S	186.89 ±13.55	194.41 ±2.26

* mineral with asterisk differ significantly ($P<0.05$) for the specified animal.

The mean values of some micro minerals in striploins from beef and venison are shown in table 2. Iron (Fe) is a very important element that is normally used as a selling factor for red meats due to its physiological importance. Deficiencies in Fe cause severe health problems. The recommended daily intake (RDI) of Fe for adult male is 8mg while adult female is 18mg (Ministry of Health, 2006) . Heme iron is not only readily available for absorption, but also facilitates the absorption of inorganic Fe (Anderson et al., 2005). Venison has higher Fe concentration compared to beef ($P < 0.05$), which makes it a good choice to compliment the daily intake requirement at a smaller portion size. Venison striploins had almost twice the manganese (Mn) concentration of beef (Table 2). Mn is an essential element involved in the formation of bones and connective tissues, and is also involved in numerous enzymatic reactions (Santamaria & Sulsky, 2010). Mn deficiency is associated with several pathological conditions (Santamaria & Sulsky, 2010). The amount of copper (Cu) in venison loins was almost 3 times of that found in beef loins. As the deer were fed Cu in their diet in order to overcome Cu deficiency, this result was not unexpected (Handeland et al., 2008). Cu is an important mineral as it aids in the formation of red blood cells, bones, hemoglobin and the production of connective tissues. The RDI for Cu is between 1.2-1.7 mg daily and the maximum allowable level is 10 mg/day (Ministry of Health, 2006). Beef striploins were higher in Zinc (Zn) compared to venison striploins (Table 2). Zinc is an important component of several metalloenzymes and is involved in protein structures as well as gene expression regulation (Maret & Sanstead, 2006).

Although several mineral elements are required for optimal health and physiological functions (e.g. Mg, Mn, Fe, Zn) in excess of minerals can be detrimental to human health.

In addition to the above mentioned minerals, several toxic minerals could exist due to environmental and dietary factors (Table 3). Aluminum (Al) and Lead (Pb) concentrations in venison striploins was about half that found in beef loins (Table 3). Also, Cadmium (Cd) concentration in venison was about 20% of that found in beef. The accumulation of Al, Pb and Cd is linked to various health problems and physiological conditions (Nayak, 2002; Staessen et al., 1999; Gidlow, 2004). The Nickel (Ni) concentration was numerically higher in beef than venison and there was a large variation among different samples. Adult RDI should not exceed 25-35 ㎍ per day (Anke et al., 1995).

Table 2. Mean value and SD of micro minerals from strip loins of beef and venison

Mineral (µg/100g)	Beef	Venison
Cr	11.76 ±2.63	8.51 ±0.52
Cu*	59.53 ±6.11	171.9 ±24.2
Fe*	2278 ±280	2846 ±348
Mn*	13.88 ±0.55	23.10 ±2.39
Zn*	3241 ±262	2297 ±277

* mineral with asterisk differ significantly (P<0.05) for the specified animal.

Table 3. Mean value and SD of toxic minerals from strip loins of beef and venison

Mineral (µg/100g)	Beef	Venison
Al*	466.60 ±149.40	224.30 ± 31.50
Cd*	3.39 ±1.44	0.73 ±0.13
Ni	20.15 ±8.69	8.10 ±2.08
Pb*	6.53 ±1.27	3.62 ±0.85

* mineral with asterisk differ significantly (P<0.05) for the specified animal.

Conclusions

Venison and beef both contains minerals required for good health. New Zealand farmed venison is a healthier alternative to beef due to its higher concentration of minerals required for good health.

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