Compositional difference of beef from three different beef breeds in Canada

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Introduction

- To produce high quality meat, it is necessary to evaluate variables related to animal production, mainly genetics as well as variables associated with the processing of meat.
- Breed is an important factor that can influence the characteristics of the raw muscle tissue and hence the finished product. A large number of genetically distinct cattle breeds exist in Canada, and this diversity could produce beef of different qualities. The quality of the beef from different beef breeds has been evaluated in several studies (Prado et al., 2009; Christensen et al., 2011) and different qualities such as moisture content, shear force values, fat content and tenderness have been noted.
- The objective of our study was to determine the difference in the chemical composition of the *Longissimus lumborum* (LL) and *Gluteus medius* (GM) muscles between three breeds: Angus, Charolais and a University of Alberta Kinsella Farm Angus crossbred.

Materials and Methods

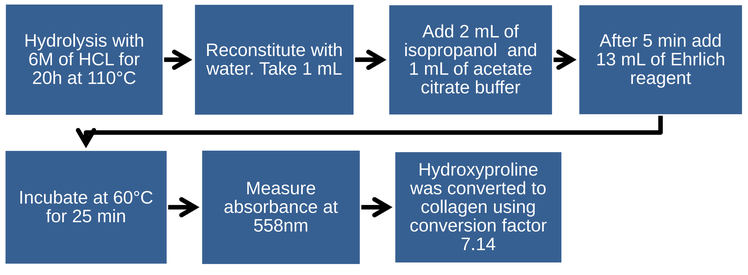
Animal Production

A total of 71 cattle were used in our study. The three different breeds were Charolais (n = 24), Angus (n = 23) and Angus crossbred (n = 24).

Proximate composition of meat

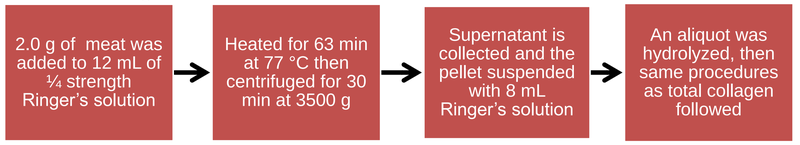
- Proximate composition of meat analysis was completed according to the Association of Official Analytical Chemists (AOAC, 2000) international standard method.
- **Ash** content was determined by measuring 2 g of freeze dried meat, which was then placed in an oven for approximately 12 hours at 110°C. Then, the samples were cooled in a desiccator and weighed. The samples were placed in a muffle furnace at 490°C overnight. Ash (%) in fresh meat was calculated by the equation = [(ash weight (g) / freeze dried meat weight) x100] x dry matter in freeze dried meat .
- **Crude Protein** was determined by weighing 0.1 g of freeze dried meat in aluminum foil which was then made into a pellet. The pellet was then placed in the LECO machine where combustion occurs at 1000 °C which splits carbon and nitrogen. The nitrogen is measured and is multiplied by a conversion factor 6.25 to calculate the % of protein in the sample.
- **Moisture** was measured after first trimming the epimysium from the steak. Then the beef was cut into cubes and weighed. The beef was frozen and freeze dried in a freeze dryer for 7 days. Moisture (%) was calculated using [Freeze dry meat weight (g) / Total fresh meat weight (g)] x100.
- **Fat Content** was determined using the formula [100 - (% Crude Protein + % Ash + % Moisture) = % Fat.

Total Collagen



Materials and Methods Cont'd

Soluble Collagen



Warner Bratzler Shear Force (WBSF)

- A 2.5 cm thick steak was trimmed and placed in a plastic bag before being cooked in a water bath at 73°C until the internal temperature of the steak reached 71°C. Once cooked, steaks were cooled and stored overnight at 4°C. Cores with a 1.27 cm diameter were removed from each steak and cut perpendicular to muscle fibre direction with a materials testing machine fitted with a shear force blade to estimate the peak force (Newtons) required to cut the meat.

Statistical Analysis

- Two-way analyses of variance were conducted for beef composition and WBSF with breed and muscle as the main effects using the Statistical Analysis Software (SAS Institute, Cary, North Carolina) with significance at P< 0.05.

Results

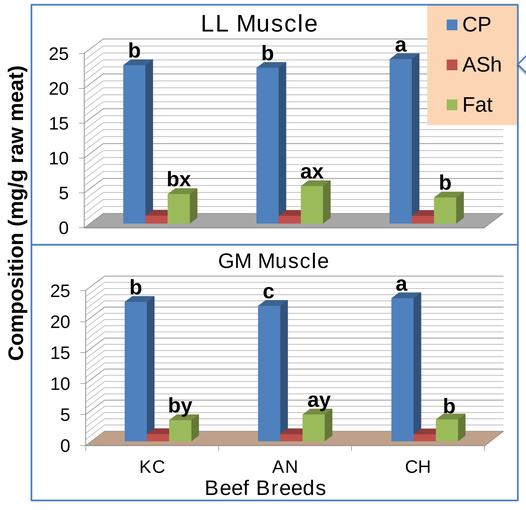


Figure 1: Proximate composition in LL and GM muscles of Kinsella crossbred (KC), Angus (AN) and Charolais (CH) breeds. Different letters (a, b, c) within the same measurement indicate significant differences among the breeds within the same muscle. Different letters (x, y) above the bars for the same parameter indicate that there is a significant difference between the muscles in same breed.

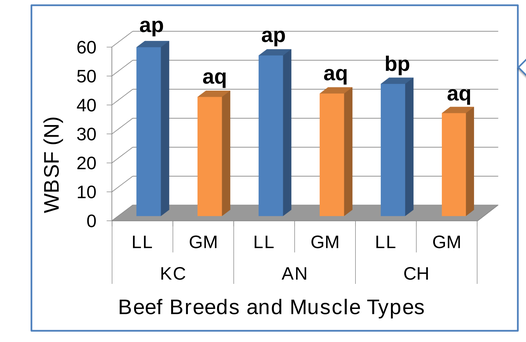


Figure 2: Warner-Bratzler Shear Force (WBSF) means from LL and GM muscles from Kinsella crossbred (KC), Angus (AN) and Charolais (CH) carcasses. Different letters (a, b) above the bars for the same muscle indicate that there is a significant difference between the breeds. The different letters (p, q) above the bars indicate that there is a significant difference between the muscles within breed.

Results Cont'd

Muscles	Beef Breeds		
	KC	AN	CH
LL	4.02ay	3.55aby	3.23by
GM	5.75ax	6.13ax	7.13ax

Table 1: Total collagen (mg/g raw meat) in LL and GM muscles of Angus, Charolais and Kinsella crossbreds. The different letters (a, b) indicate significant difference among breeds in the same muscle while (x, y) between muscles in the same breed.

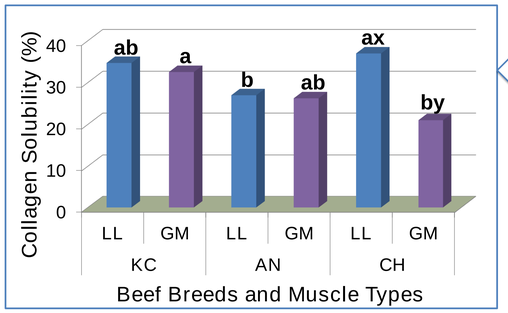


Figure 4: Collagen solubility (%) in LL and GM muscles of Angus, Charolais and Kinsella crossbreds. The different letters (a, b) indicate significant difference among breeds in the same muscle while letters (x, y) indicate significant differences between muscles in the same breed.

Conclusions

- LL muscle, which is usually used for steak, are more tender in the Charolais breed than the Angus and Kinsella composite breeds but tenderness as measured by WBSF for the GM muscle did not differ between breeds.
- LL muscle had higher WBSF values than the GM muscle in all three breeds. Therefore, GM muscle is more tender that the muscle LL which is usually used for steak preparation.
- Generally, beef is tough when it contains high total collagen and low collagen solubility. But in this study, GM muscle contained more collagen and yet was more tender than LL muscle. It might be that meat tenderness not only depends on collagen content and solubility but on other factors that affect the muscle proteins.
- GM muscle from all three breeds might be useful as a steak for retail as a tender product.

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