Session 08 – Abstract Number: 0980

Elevated rate of collagen solubilisation in muscles of Holstein bulls fed high energy diet

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INTRODUCTION

Grazing animals are known to produce meat with higher dietetic/nutritional quality. Nevertheless, due to its toughness, meat from animals fed exclusively from grass tends to have lower commercial value. Tenderness and sensory characteristics of meat are influenced by collagen content and solubility. Several factors (e.g. muscle, breed, diet, age, sex) are known to influence collagen content and its properties. Thus, energy supplementation of grazing animals may increase meat tenderness without influencing its nutritional characteristics.

The main objective of this study was to evaluate the effect of energy supplementation of grazing bulls on collagen content and solubility in three different muscles: *longissimus dorsi* (LD), *semi tendinosus* (ST) and *supra spinatus* (SS).

MATERIAL & METHODS

Thirty three Holstein bulls aged 15±2 (SD) months with 387±51(SD) Kg live weight were randomly assigned to three treatment groups: 1) fed *ad libitum* on grass exclusively (control); 2) fed *ad libitum* on grass and supplemented with 4 kg/head/day of ground maize; 3) fed *ad libitum* on grass and supplemented with 8 kg/head/day of ground maize. Treatments lasted 85 days.

Collagen concentration was determined by the hydroxyproline content, using the conversion factor 7.25, and expressed as mg of collagen per g of wet muscle. The solubility of the collagen was determined by heating to 77 °C in Ringer´s solution (diluted 1:3) for 70 min., followed by measurement of the residual (or insoluble) collagen. Soluble collagen was determined by the difference between total collagen and heat-insoluble collagen.

RESULTS & DICUSSION

Total collagen content in each muscle (LD, ST and SS) was not affect by energy supplementation with ground maize, as no differences (P>0.05) were found among treatments (Figure 1). Whatever the diet, grass or supplementation with maize, LD had significantly lower (P<0.001) total collagen (6.24 mg/g) compared to ST (11.4 mg/g) and SS (14.8 mg/g).

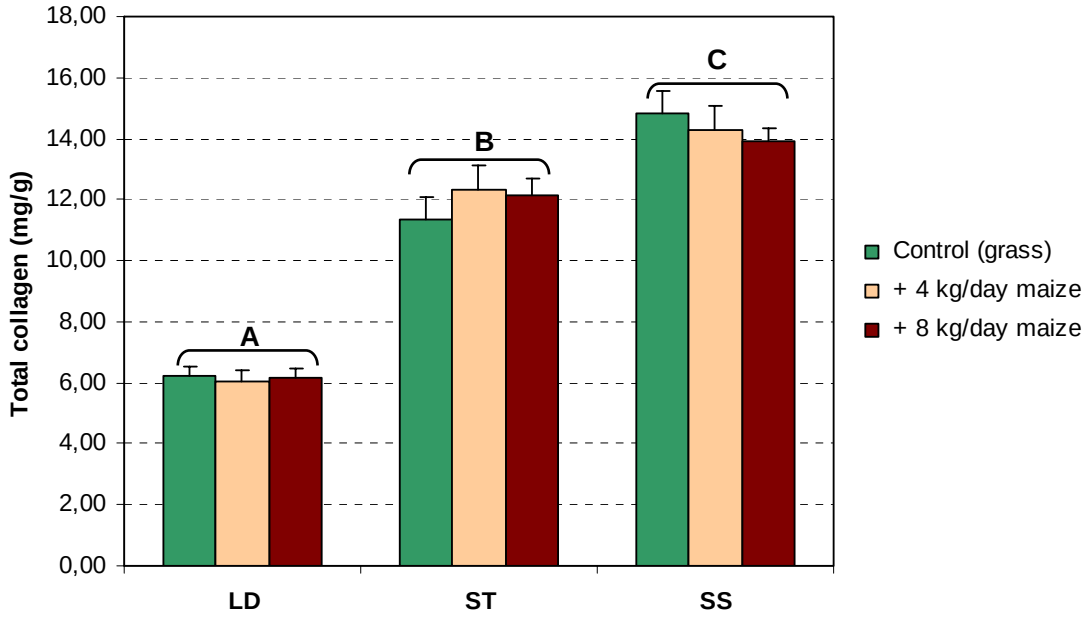

Figure 1. Total collagen content in bovine *longissimus dorsi* (LD), *semi tendinosus* (ST) and *supra spinatus* (SS) muscles. Measurements are the result of triplicates (11 animals per diet). The results are presented as the mean ± SEM of individual determinations and expressed in mg/g of wet muscle. Different letters (A,B,C) indicate significant differences (p<0.001) among muscles.

Energy supplementation of grazing animals, significantly (P<0.001) increased the percentage of soluble (heat-labile) collagen (Figure 2). Collagen solubility was significantly higher in animals supplemented with 8 kg/head/day of maize (34%, 23% and 25% in LD, ST and SS, respectively), compared to animals supplemented with 4 kg/head/day of maize (26% in LD and 19% in both ST and SS muscles) and animals fed on grass exclusively (24%, 18% and 17% in LD, ST and SS, respectively). In control animals, collagen solubility was significantly (P<0.001) higher in LD (24%) compared to the other muscles (18% and 16% in ST and SS, respectively). Similar trend was observed in energy supplemented animals (Figure 2).

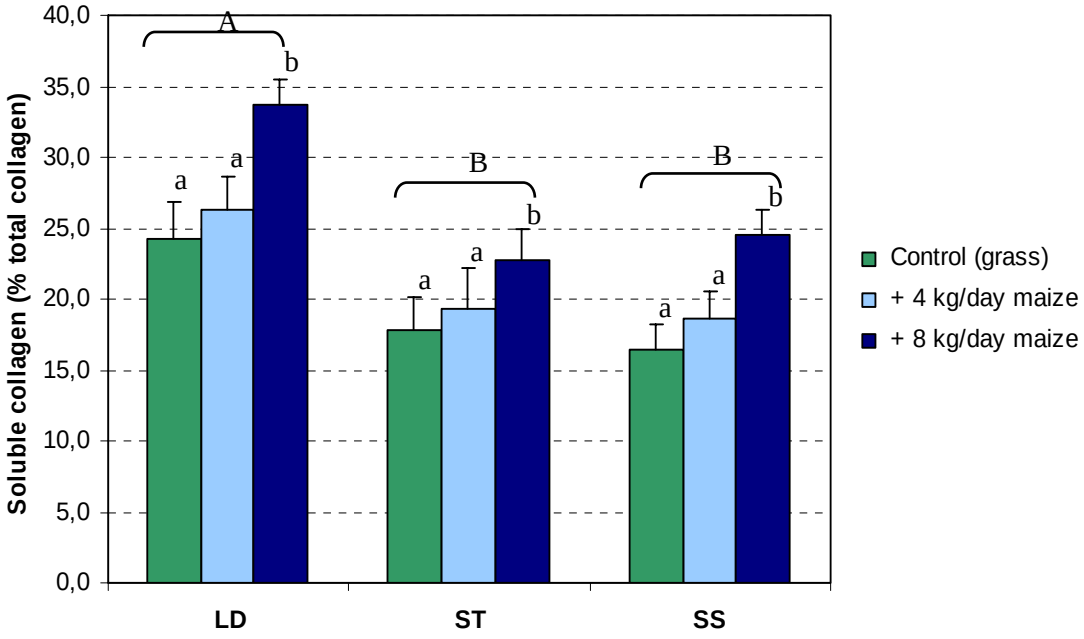

Figure 2. Soluble collagen in bovine *longissimus dorsi* (LD), *semi tendinosus* (ST) and *supra spinatus* (SS) muscles. Measurements are the result of triplicates (11 animals per diet). The results are presented as the mean ± SEM of individual determinations and expressed as percentage of total collagen. Different letters (a,b) indicate significant differences ($p<0.005$) among treatment groups (diets) and capital letters (A,B,C) designate significant differences ($p<0.001$) among muscles.

CONCLUSION

In conclusion, energy supplementation had no effect on total collagen, but produced meat with higher collagen solubility due to a higher proportion of neo-formed collagen, which is less cross-linked. Therefore, meat tenderness of grazing bulls may be improved by supplementing with 8 kg/head/day of ground maize, as a result of the rising in collagen solubility.

ACKNOWLEDGMENTS

This project was supported by CITAA