RELATIONSHIP BETWEEN SHORT TERM ENERGY SUPPLEMENTATION AND MEAT QUALITY OF STEERS IN ARGENTINA

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Introduction

Nutrition affects tissue fatty acids in cattle. The w-6: w-3 fatty acids in meat from forage finished cattle is approximately 2 (Enser *et al*., 2001), well below the recommended level of less than 4 (Holman, 1995). Short term maize grain supplementation in the finishing stage of beef cattle, a common practice in pastoral systems, did not affect fatty acid profile (Grigera Naón *et al*., 2000). On the other hand, enhanced levels of conjugated linoleic acid (CLA) in adipose tissue were found in cattle grazing pastures (French *et al*., 2000) , CLA concentration has also been increased by including extruded full-fat soybeans in feedlot diets (Madron *et al.*, 2002). Full-fat soybean is an expensive commodity, produced for human consumption and recently used as a biodiesel source. Therefore, it becomes relevant to explore the strategic use of by-products of soybean harvest for feeding grazing cattle in the latter stage of fattening, taking into account that up to 60% (on a dry matter basis) of such material is made of cracked soybeans (Grigera Naón *et al.*, 2003). However, (Grigera Naón *et al.*, 2003) showed that using such by-products as the unique source of supplementary feeding, had some undesirable effects, such as a poorer fattening rate in comparison with those animals offered maize grain. Such supplementation also resulted in a lower CLA proportion as well as a higher w-6:w-3 in intramuscular fat (IMF) of steers .

The objective of the present study was to assess the direct and carry-over effects of short term supplementation, with a mixture of cracked maize grain and by-products of soybean harvest in terms of fatty acid composition of the adipose tissue, colour and tenderness of meat.

Materials and methods

Twenty two, 20 months old Red Angus steers (initial liveweight 357 ± 17 kg) were randomly allotted to either grazing a mixed temperate pasture, based on red clover, white clover, tall fescue and bromegrass (PO) (n = 8) or grazing the same pasture and offered a supplement made of cracked maize grain (0.85% liveweight) and by-products of soybean harvest (0,25 % liveweight) (MS) (n = 14). After 92 days of supplementation, seven steers were finished and slaughtered, additional feeding was stopped and the remainng seven animals in MS were fattened on pasture, thus giving treatment CMS to assess carry-over effects of supplementation. Animals rotationally grazed a 17 hectares field divided in 2.5 hectares paddocks. Slaughter point was in every case determined by the same trained abattoir official. Samples of muscle *Longissimus dorsi* were obtained. Fatty acids were extracted according to Folch *et al*. (1957) and analyzed as methyl esters by gas chromatography. Tenderness was measured with an Instron 4442 Universal Testing Machine (Canton, MA, USA) with a Warner-Bratzler shearing attachment on cooked samples (water bath heating at 70 ^{0}C for 50 minutes). Data were analyzed using GLM procedure SAS (1999). Colour was measured according to the CIELAB System, L* (lightness), a* (redness) and b* (yellowness), using a Minolta Chroma Meter-CR300.

Results and Discussion

Significant differences ($P < 0.05$) (Table 1) in the content of individual fatty acisds were restricted to increased linoleic acid concentration and to decreased CLA contentin IMF with supplemetary feeding. These results confirm previous studies reported by Grigera Naón *et al.* (2003) when fed by-products of soybean harvest as unique supplement.

Table 1. Fatty acid composition as percentage of muscle lipids

Treatment	PO	CMS	MS	se
18:2 w 6	4.2^{a}	5.5^{ab}	7.1^{b}	1.21
CLA*	0.91^{a}	0.70^{ab}	0.56^{b}	0.139
SAT	44.5^{ab}	46.1^{b}	42.9^{a}	1.82
PUFA	9.0^{a}	9.7^{ab}	12.1^{b}	1.91
w-6	6.4^{a}	7.5^{ab}	10.0^{b}	1.63
w-6/w-3	3.3^{a}	4.7^{ab}	6.4^{b}	1.13

[a-b] Means in the same row without a common superscript letter differ significantly ($P < 0.05$). CLA* cis-9, trans-11.

It would have been expected, according to Madron *et al*., 2002 a higher proportion of CLA associated with higher values of linoleic acid in MS, due to the fact that this acid is a precursor of CLA in the rumen. However the aforementioned authors used, over a longer period, feedlot diets based on extruded soybeans with a higher energy concentration than the diets consumed by the steers in our study. Therefore, this issue marks the need of further investigation. The proportion of plyunsaturated fatty acids (PUFA) and of w-6 acids increased with supplementation, this brought about a higher ratio w-6:w-3, above the suggested healthy level of 4. Treatment CMS showed intermediate values for all parameters, except SAT, which points to the verification of carry-over effects.

Table 2. Meat quality characteristics

Treatments	PO	CMS	MS	se
DM (%)	29[a]	30[a]	26[b]	0.8
IMF (%)	5.7[a]	4.9[ab]	3.3b	0.4
pH	5.52	5.67	5.53	0.8
L*	40.1	39.1	40.2	1.29
a*	22.6	22.5	23.7	1.25
b*	12.7	12.6	13.7	0.92
Shear force,kg	6.9	7.1	7.9	0.43

[a-b] Means in the same row without a common superscript letter differ significantly ($P < 0.05$).

Supplementation (MS) did not result ($P < 0.05$) in enhanced IMF (table 2) in spite that animals were slaughtered at comparable subcutaneous fat content. Meat from supplemented steers tended ($P < 0.1$) to be tougher which can be attributed to lower (IMF) and dry matter content (DM) in MS.

Conclusions

Supplementing grazing steers with a mixture of cracked maize grain and by-products of soybean harvest did not affect tenderness and caused significant changes, albeit not always beneficial to human health, in the content of some fatty acids in muscle *Longissimus dorsi*. Carry-over effects were also recorded after supplementation was stopped.

References

1. Enser, M., Scollan, N., Suresh Gulati, Richardson,.Nute, G. and Wood, J. (2001). The effects of ruminally-protected lipids on the lipid composition and quality of beef muscle. *Proc. 47th ICoMST*,186-187.Cracow, Poland.

2. Folch, J., Lees, M. and Sloane, S. G. H. (1957). A simple method for the isolation and purification of total lipids from animal tissues. *J. Biol. Chem. 226*, 497 – 509.

3. Fench, P., Stanton, C., Lawless, F., O'Riordan, E. G., Monahan, F. J. and Moloney, A. P. (2000). Fatty acid composition, included conjugated linoleic acid, of intramuscular fat from steers offered grazed grass, grass silage, or concentrate-based diets. *J. Anim. Sci. 78*, 2849-2855.

4. Grigera Naón, J. J., Schor, A., Cossu, M. E.,Schindler de Avila, V. and Panella, F. (2003). The effects of feeding by-products of soybean harvest on the lipid composition and quality of beef. *Proc. 49th ICoMST*, 133-134. Campinhas, Brazil.

5. Grigera Naón, J. J., Schor, A., Cossu, M. E., Trinchero,G. and Parra V., (2000). Influence of strategic maize grain supplementation on cholesterol andfatty acids of *longissimus* and *semitendinosus* muscles of beef steers at grazing. *Proc. 46th ICoMST*, 156-157. Buenos Aires, Argentina.

6. Holman, R. (1995). Essential fatty aciods in health and disease. Actas de la Jornada de Actualización:Las carnes en la nutrición y salud humana. Academia Nacional de Medicina, Buenos Aires, Argentina.

7. Madron, M. S., Peterson, D. G., Dwyer, D. A., Corl, B. A., Baumgardt, L. H. and Bauman, D. E. (2002). Effect of extruded full-fat soybeans on conjugated linoleic acid content of iontramuscular, intermuscular and subcutaneous fat in steers. *J. Anim,. Sci. 80*: 1135-1143.

8. SAS User's guide: statistics version 6.12 (1999), SAS Inst. Inc. Cary, N. C.