Concentrate Finishing Affects Muscle *Trans*-18:1 and CLA Profile of Grass Fed Steers

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Finishing cattle on concentrate can be economical and enhance marbling levels, while finishing on grass improves the profile of muscle fatty acids (FA). Current recommendations for human health are to limit intakes of saturated fats and increase intakes of ω-3 FA. Of current interest are also intermediates in ruminal biohydrogenation of polyunsaturated FA, especially the conjugated linoleic acid (CLA) rumenic acid (*cis*9,*trans*11-18:2) and vaccenic acid (*trans*11-18:1) that have purported roles in the prevention of several diseases (Field *et al* 2009). These metabolites accumulate in grass-finished beef, while *trans*-18:1 isomers (notably *trans*10-18:1) accumulate in concentrate-finished beef and are atherogenic (Bauchart *et al* 2007). To evaluate the benefits of combining intensive and extensive systems, 24 steers from "Asturiana de los Valles" Spanish breed (heterozygote for the gene responsible for muscular hypertrophy) were reared under grazing conditions (ryegrass/clover pastures) with or without final finishing on barley-based concentrate for either 0 (n=4), 2 (n=12) or 3 months (n=8). Animals were slaughtered commercially at an average weight of 498±8.4 kg.

All samples (*longissimus thoracis* muscle) were freeze-dried and lipids were extracted using a mixture of chloroform–methanol (1:1, v/v). Lipid aliquots from each muscle were methylated separately using acidic (methanolic HCl) and basic (sodium methoxide) reagents and FA methyl esters were analyzed using GC (acidic & basic) and Ag^{+}-HPLC (basic; Kramer *et al* 2008).

Increasing the time on concentrate increased the total FA content of meat (0.88% on grass-fed *vs* average of 1.9% on concentrate-finished) which was reflected in a decrease of polyunsaturated to saturated FA (P/S) and increase of ω-6/ω-3 ratio (Table1). Finishing on grass or with a short period on concentrate (~2 months) enhanced the meat FA profile by decreasing total *trans*-18:1 and specifically *trans*10-18:1, while there were no differences in vaccenic acid (*trans*11-18:1) content. There were no differences in rumenic acid between treatments while an increase was observed in the second most abundant CLA isomer (*trans*7,*cis*9-18:2) with increasing time on finishing.

Meat from concentrate-finished animals had higher total FA content in comparison to grass-finished samples. However, pasture-finished beef showed an improved fatty acid profile enabling beef production with a more desirable fatty acid composition for human health.

Table 1. Muscle *trans*-18:1, CLA and ratios of steers from "Asturiana de los Valles" breeds

Months finishing	0 mo	2 mo	3 mo	sem	sign	0 mo	2 mo	3 mo	sem	sign
mg FAME/100g meat	878[b]	1701[a]	2108[a]	140.7	*					
	mg/100g of meat					% of total FAME				
*trans*10-18:1	1.85[b]	28.8[b]	133[a]	6.607	***	0.20[c]	1.77[b]	6.34[a]	0.286	***
*trans*11-18:1	22.4	32.8	33.8	4.218	ns	2.29	1.86	1.61	0.137	ns
Total *trans*-18:1	36.9[b]	85.5[b]	202[a]	9.859	***	3.82[b]	4.99[b]	9.63[a]	0.310	***
*cis*9,*trans*11-18:2	3.12	5.83	5.71	0.667	ns	0.32	0.34	0.27	0.024	ns
*trans*7,*cis*9-18:2	0.20[c]	0.78[b]	1.53[a]	0.097	***	0.02[c]	0.05[b]	0.07[a]	0.004	***
Total CLA	4.95	8.93	11.5	0.919	ns	0.52	0.53	0.54	0.029	ns
P/S	0.44[a]	0.26[b]	0.17[b]	0.026	**					
ω-6/ ω-3	2.45[c]	4.49[b]	5.97[a]	0.195	***					

FAME, FA methyl esters; sem, standard error of the mean; sign, significance; *p<0.05, **p<0.01, ***p<0.001; P/S, polyunsaturated FA/saturated FA. Analyses of finishing by ANOVA (SPSS for Windows).

Bauchart D., Roy A., Lorenz S., Chardigny J.M., Ferlay A., Gruffat D., Sebedio J.L., Chilliard Y. and Durand D. (2007). *Lipids* **42**, 123.

Field C.J., Blewett H.H, Proctor S. and Vine D. (2009). *Appl. Physiol. Nutr. Metab.* **34**, 979.

Kramer J.K.G., Hernández M., Cruz-Hernández C., Kraft J. and Dugan M.E.R. (2008). *Lipids* **43**, 259.

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