INFLUENCE OF GRAZING SYSTEMS ON VEAL FATTY ACID PROFILE

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Keywords: calves, pasture, CLA, ω-3, *longissimus thoracis*

Introduction

Beef is often criticised for having higher proportions of saturated fatty acids (SFA) than plant food. However, beef usually contains an array of fat molecules that have beneficial effects on human health (Moloney *et al.*, 1999). Grass-based diets are the main sources of C18:3 ω-3 for animal feeding. Consumption of C18:3 ω-3 has been recommended to improve nutritionally the ω-6: ω-3 ratio in humans. Moreover, in recent years, it has been demonstrated that the conjugated linoleic acid (CLA) has important biological effects, including anticarcinogenic activity (Visonneau *et al.*, 1997) and the ability to reduce atherosclerosis (Ip *et al.*, 1994). CLA is found naturally in a variety of ruminant fats, as a result of incomplete biohydrogenation of linoleic and linolenic acid by the rumen bacterium. Diets rich in these fatty acids increase the concentration of the CLA in the fat deposit of the animal. Therefore, grazing-based diets of cattle increase the concentration of CLA and the ω-3 polyunsaturated fatty acids (PUFA) when compared to concentrate-based diets (French *et al.*, 2000). The objective of this study was to investigate the effect of the different beef production systems from the North West of Spain (Galician region) on the fatty acid profile of the intramuscular lipid.

Materials and Methods

Thirty male Rubia Gallega-breed calves were assigned at random to three different finishing treatments (10 calves/treatment): (1) a concentrate and hay *ad libitum* diet was provided to calves housed indoors for 165 days, following a previous grazing period of 57 days (C); (2) Calves were fed on pasture for 197 days complemented by concentrate during the last month of grazing, after which they were finished indoors with concentrate and hay *ad libitum* for an additional 50 days (PC); and (3) Calves were grazing only on a rotational system followed by a pasture-finishing program for a total of 250 days (P). In all treatments, calves kept suckling their mothers up to the slaughter time. During the indoor period, PC and C animals suckled twice a day. Calves under the P and PC treatment were slaughtered four and three weeks later respectively than those under the C treatment, to allow the animals to reach the same slaughter weight (about 330 kg). Carcasses were chilled for 48h at 4°C. Samples of the *Longissimus thoracis* muscle were collected, split into steaks, vacuum packed and stored at –20°C, which were later used for the assessment of nutritional composition (fatty acid content). Intramuscular fat was extracted and methylated. Fatty acids (FA) were analysed by gas chromatography with a 100 m CP-Sil 88 column and the concentration of individual fatty acids in the muscle was determined. Data were statistically analysed using the General Linear Model (GLM) of the SAS package.

Results and Discussion

Fatty acid (FA) data are summarised in Table 1. Concentration of C18:3 ω-3 showed significant differences (P<0.001) among treatments, reaching the highest value in animals which were only grazing for 250 days (P).
However, no differences were found for this ω-3 FA between animals which were finishing on concentrate for 165 and 50 days, C and PC respectively. This reveals that the relative increase in the C18:3 ω-3 FA was due to the effect of finishing animals on a pasture program compared to finishing on concentrate. The same data pattern was found for total ω-3 PUFA content in intramuscular fat.

Table 1: Average concentration (mg/100 g muscle) of main FA in *Longissimus thoracis* muscle.

FA	Grazing Days (Treatments)			
	250 (P)	197 (PC)	57 (C)	F-test ‡
C18:1 trans 11 (TVA)	14.08 ± 0.85	12.53 ± 1.34	16.35 ± 1.63	+
C18:2 ω-6c (linoleic)	81.62 ± 7.12	80.32 ± 6.57	110.65 ± 15.73	+
C18:3 ω-3 (linolenic)	60.48 ± 4.67	28.33 ± 3.38	26.99 ± 1.93	***
CLA c9t11	8.05 ± 0.36	5.50 ± 0.67	5.30 ± 0.39	**
PUFA	266.57 ± 19.68	185.36 ± 16.69	223.48 ± 24.12	*
MUFA	747.39 ± 41.35	840.97 ± 101.77	1035.14 ± 74.58	+
SFA	1109.04 ± 56.69	1181.61 ± 132.58	1341.19 ± 64.74	NS
ω-6 PUFA	107.93 ± 9.43	96.92 ± 8.24	136.32 ± 18.73	NS
ω-3 PUFA	150.59 ± 10.51	82.94 ± 9.15	81.85 ± 6.19	***
PUFA:SFA Ratio	0.23 ± 0.03	0.17 ± 0.02	0.17 ± 0.02	NS
ω-6: ω-3 Ratio	0.73 ± 0.02	1.24 ± 0.09	1.62 ± 0.12	***

†Values after ± refer to the standard deviation of the mean.
‡ +=<0.1, *=<0.05, **=<0.01, ***=<0.001, NS= Not Significant.

Animals under the P treatment showed significantly ($P<0.001$) higher concentration in total ω-3 PUFA than animals under C and PC treatments, whereas no differences were found between C and PC. It seems that content of ω-3 FA in veal fat is highly influenced by the type of diet on which animals were fed during the finishing period. Significant differences ($P<0.01$) were also found between calves under the P treatment and those under the C and PC treatment for the CLA content, whereas no differences were found between C and PC. This may be explained by the same reasons as mentioned above.

Data of associations of grazing levels and pertinent nutritionally parameters were fitted to linear regression straights. These linear regressions represent graphically the data discussed above.

Figure 1
Association of grazing levels and CLA

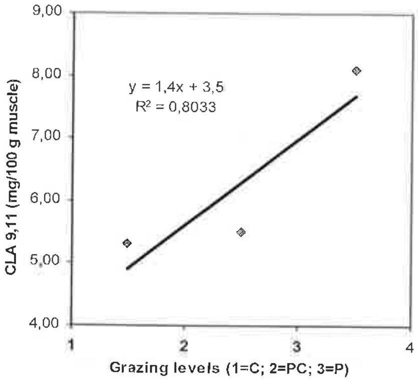


Figure 2
Association of grazing levels and ω-3 PUFA

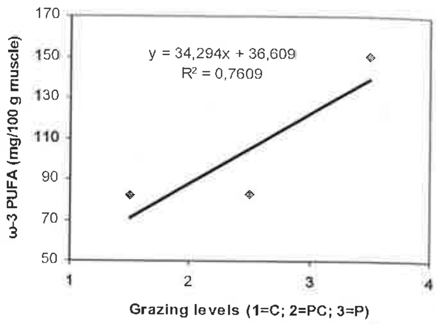
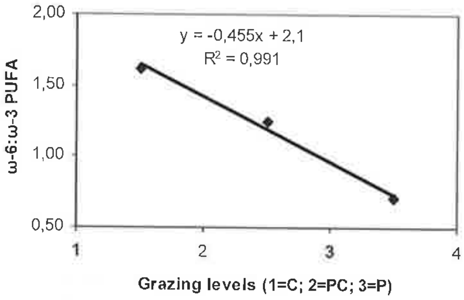


Figure 3
Association of grazing levels and ω-6:ω-3 PUFA



Conclusions

Diets based on pasture finishing improved the content of some healthy fatty acids in veal, such as C18:3 ω-3, ω-3 PUFA, PUFA, CLA and ω-6: ω-3 ratio, compared to concentrate finishing for young calves.

References

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