

# EFFECT OF THE FINISHING DIETS ON BEEF NUTRITIONAL COMPOSITION OF SIX COMMERCIAL MUSCLES

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## Introduction

Nowadays beef consumers and human nutritionists are very much concerned about total fat consumption and its nutritional composition rates, such as PUFA/SFA and n-6/n-3 ratios, due to their incidence on obesity and cardiovascular problems. Conjugated linoleic acid (CLA) is also a subject of interest because of its anticarcinogenic action (Parodi, 1994). It has been verified that grazing diets on animals have beneficial effects on PUFA/SFA and n-6/n-3 ratios, increase in CLA content and decrease in SFA content of beef (Enser *et al.*, 1998; French *et al.*, 2000). Beef production systems in the region of Galicia, North West of Spain, have been based on herds of the late maturing breed Rubia Gallega (RG), where calves are slaughtered very small (7-9 months of age), and animals are usually reared and/or finished with concentrate feed, which increase fat deposition. The Protected Geographical Indication (PGI) "Terneira Gallega" commercialises mainly the "Terneiro" type, slaughtered before 10 months of age, and the "Añojo" type, slaughtered between 10-18 months, which represents only 3% of total commercialised calves. However, it should be interesting to encourage beef production based on grazing systems with or without a concentrate finishing for economical and technical reasons. In addition, analyses of the intramuscular fatty acid composition are usually studied on the *Longissimus dorsi* muscle, although it is known that there are differences between muscles (Enser *et al.*, 1998). Since there is a paucity of information in this regard, the objective of this study was to document the effect of grazing finishing diets on the fatty acid composition of main commercial muscles in the "Añojo" type.

## Materials and Methods

Twenty male calves of RG breed were randomly assigned to either grass (GF) or concentrate finishing (CNF). Calves were weaned at 8-9 months and grazed on a rotational system until 11 months of age. At this time, one group of ten calves continued grazing for 65 days in a meadow sown with *Lolium perenne* and white and red clover, whereas the other group of ten calves, were fed 65 days on a concentrate *ad libitum*, composed of a mixture of barley (81%), soybean meal (14%) and mineral/vitamin mix (5%) and hay. Post-slaughter, weight conformation (EUROP) and fat score (1 to 5) of the carcasses were recorded. Two-days post-mortem samples of the *longissimus thoracis* (LT), *Semimembranosus* (SM), *Semitendinosus* (ST), *Gluteus medius* (GM), *Cuadriceps femoris* (CF) and *Gluteus Biceps* (BF) were collected and used for fatty acid analysis by gas chromatography. Data were statistically analysed using a correlation procedure and an analysis of variance of the SAS package (SAS, 1999).

## Results and Discussion

Weight, conformation and fat score of the carcasses averaged respectively 251 kg, R-O, and 2.5 for GF and 300 kg, U-R, and 2.8 for CNF. The correlation coefficients between LT muscles and the other muscles (Table 1) were high for n-3 content, moderate for n-6 content and low or very low for the other parameters studied.

Table 1: Correlation coefficients (signification level) between *L. thoracis* (LT) and *gluteus biceps* (GB), *Cuadriceps femoris* (CF), *gluteus medius* (GM), *semitendinosus* (ST) *semimembranosus* (SM) muscles.

Fatty acid	Muscle	Muscle				
		GB	CF	GM	ST	SM
SFA	LT	0.46 (*)	0.41 (+)	0.09 (n.s)	0.03 (n.s)	0.21 (n.s)
MUFA	LT	0.37 (+)	0.19 (n.s)	-0.26 (n.s)	0.06 (n.s)	0.01 (n.s)
PUFA	LT	0.05 (n.s)	0.54 (**)	0.28 (n.s)	0.19 (n.s)	0.59 (**)
n-3	LT	0.74 (***)	0.79 (***)	0.78 (***)	0.71 (***)	0.83 (***)
n-6	LT	0.32 (n.s)	0.67 (**)	0.49 (*)	0.62 (**)	0.77 (***)
CLA	LT	0.65 (***)	0.52 (*)	0.45 (*)	0.23 (n.s)	0.27 (n.s)

Muscles of GF had more n-3 content and less n-6/n-3 ratio than CNF calves, as previously reported by Enser *et al.* (1998) and French *et al.* (2000), but the differences were smaller in this study than in the other studies. Also as these authors reported, GF calves had a higher value of CLA and PUFA/SFA and lower value of n-6 than CNF calves (Table 2), although the differences were not significant for all muscles. Discrepancy about smaller differences between GF and CNF treatments in this study and the other studies could be due to that intramuscular fat is deposited very late in the RG breed (Brea *et al.*, 1997).

There were significant differences among muscles of the GF calves in all parameter studies (Table 2). The LT muscle had lower n-3, n-6 content and PUFA/SFA ratio and higher n-6/n-3 ratio than the other muscles. The SM and ST muscles had the lowest fat and CLA content, likely because of the difference in phospholipid concentration, which is the greatest in red oxidative muscle fibres (Turkki and Campbell, 1967). In CNF calves the LT muscle had also lower n-3 content and PUFA/SFA ratio than the other muscles, and its fat content is the highest. In the other parameters there were not differences between muscles.

**Table 2:** Some and total fatty acid (FA) content and pertinent FA ratios of *longissimus thoracis* (LT), *semimembranosus* (SM), *semitendinosus* (ST), *gluteus medius* (GM), *cuadriceps femoris* (CF) and *gluteus biceps* (GB) muscles from calves fed on grazing (GF) and concentrate (CNF) finishing diets.

FA (mg/100g muscle)	Finishing treatment	muscle						sed†
		LT	SM	ST	GM	CF	GB	
n-3	GF	19b	25a	26a	27a	27a	27a	4.64
	CNF	11b	15a	15a	14ab	15a	15a	3.23
	Sig. Level‡	***	***	***	***	***	***	
n-6	GF	17c	21ab	20bc	25a	23a	23a	4.35
	CNF	24	27	28	28	30	27	7.59
	Sig. Level	**	*	**	n.s	+	+	
CLA	GF	0.89ab	0.62b	0.75b	1.09a	0.92ab	0.78ab	0.34
	CNF	0.69	0.59	0.63	0.64	0.75	0.58	0.28
	Sig. Level	*	n.s	n.s	**	n.s	+	
TOTAL	GF	460a	368b	370bb	512a	458a	452a	95.6
	CNF	498a	389b	432ab	433ab	444ab	412ab	105.6
	Sig. Level	n.s	n.s	*	*	n.s	n.s	
FA ratios PUFA/SFA	GF	0.15c	0.26a	0.25a	0.19b	0.24ab	0.24ab	0.07
	CNF	0.13b	0.22a	0.20a	0.19a	0.22a	0.22a	0.06
	Sig. Level	n.s	+	+	n.s	n.s	n.s	
n-6/n-3	GF	0.90a	0.86ab	0.77b	0.90a	0.86ab	0.87aa	0.10
	CNF	2.24	1.87	1.87	2.03	2.07	1.87	0.49
	Sig. Level	***	***	***	***	***	***	

† Means in the same row bearing different letters differ at  $P < 0.05$  (Duncan test); sed refers to standard error deviation of mean.

‡ +, \*, \*\*, \*\*\* refer to significant difference between treatments in some column at 10, 5, 1 and 0.1% level; n.s. refers to no significant difference.

### Conclusions

Composition of the LT muscle relative to the other commercial muscles studied from the carcass could be a good reference for the n-3 PUFA content but only moderately acceptable for SFA, MUFA and PUFA content. In RG breed the low intramuscular fat deposition affects the differences between the fatty acid compositions of calves fed on grass and concentrate finishing diets.

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