Intramuscular fatty acid composition and CLA content of two types of Northern Spain foals

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Introduction

In Northern Spain, as in other European areas, horsemeat consumption has a certain importance (Badiani *et al*., 1997). Recent studies (Sarriés *et al*., 2006) have shown that horsemeat fatty acid profile may be positive from a nutritional point of view, and in line with health recommendations.

Conjugated Linoleic Acid (CLA) consists of a group of geometric and positional isomers of linoleic acid to which anticarcinogenic, antiatherosclerosis, hypocholesterolemic, modulation of immune system and reduction of body fat effects (Pariza *et al*., 2001) are attributed. These substances, found in the meat and milk of ruminants, are mainly formed by biohydrogenation of grass fatty acids by rumen microflora and the desaturation of trans-fatty acids in the adipose tissue and mammary gland. However, small amounts of CLA have been found in meat from non-ruminants, as pigs (Chin *et al*., 1992). Therefore, since horse is a pseudo-ruminant, with faecal ruminant activity, and grass is present in its diet, CLA may be formed in foal tissues in a similar way to that of ruminants. The objective of the present study was to investigate the fatty acid and CLA content in foals' intramuscular fat, in two different breeds traditionally bred in Northern Spain.

Materials and Methods

Ten Burguete and ten Hispano Breton (HB) breed male foals were raised up to 16 months old, following their traditional production systems (weaned at 7-8 months and then fattened indoors on commercial concentrates), and slaughtered in an EU accredited slaughterhouse according to current EU regulations. *Diaphragm* muscle samples were obtained from 1h *post-mortem* carcasses, vacuum packed and frozen.

The total fatty acids (FA) were analysed using the method described by Aldai *et al*. (2006). Separation and quantification of the fatty acid methyl esters was carried out using a gas chromatograph (GC, Agilent 6890N, Agilent Technologies España, S.L., Madrid, Spain) equipped with a flame ionisation detector and fitted with a BPX-70 capillary column (100 m, 0.25 mm i.d., 0.2 μm film thickness, SGE, Australia). C19:0 at 10 mg/ml was used as an internal standard. Individual FA methyl esters were identified by comparing their retention times with those of an authenticated standard fatty acid mix Supelco 37 (Sigma Chemical Co. Ltd., Poole, UK). Identification of the CLA isomers was achieved by comparing retention times with those of authenticated individual standards (Matreya, LLC, Pleasant Gap, USA). Saturated (SFA), monounsaturated (MUFA) and polyunsaturated (PUFA) fatty acids, Total CLA and PUFA/SFA ratio, as well as total identified FA, were calculated. Analysis of variance (ANOVA) was performed to determine the significance of the effect of production type (breed-production system).

Results and Discussion

Main fatty acids contents (mg of FA per 100g of muscle) and percentage in total identified fatty acids of Burguete and Hispano Breton breeds are shown in table 1. The foal meat fatty acids (%) in this study were predominated by MUFA (C18:1 *cis*9) and by SFA (C16:0) in both breeds, with predominance of MUFA, as reported by Badiani *et al*. (1997). Burguete's fatty acid profile and total fat were quite difference to those obtained by Sarriés *et al*. (2006) for intramuscular fat of foals from the same breed, because they used *longissimus dorsi* muscle for their study.

Meat from both breeds had similar CLA content to that obtained by other authors in intramuscular meat from horse (Dufey, 1999) and ruminants as sheep and cattle (Bolte *et al*., 2002, Realini *et al*., 2004). It shows the potential of horsemeat as a source of those health-beneficial fatty acids.

SFA, MUFA and CLA (*cis*9-*trans*11 and *trans*10-*cis*12 isomers) percentages were higher in meat from HB foals, while Burguete's meat was richer in PUFA. Attending to the nutritional value, total fat content in 100 g of muscle was higher in Burguete's meat. That explains why SFA, MUFA and PUFA content in 100g of meat were higher that those obtained for HB meat. However, meat from HB foals had higher CLA content than that form Burguete, showing differences in CLA synthesis for both breeds. PUFA/SFA ratio of Burguete breed was over 0.4, which is the international health recommendation,

while meat from HB foals had a worse ratio, but had higher amounts of C18:1 isomers, which are also related to human health.

Table 1. Intramuscular fatty acid (FA) profile (mg FA/100g meat and % of FA in total identified FA) of Burguete and Hispano Breton (HB) foals.

	mg FA/100g meat			% FA in total FA		
	Burguete	HB	Sig.	Burguete	HB	Sig.
C14:0	320.75	263.93	***	3.92	4.03	*
C16:0	2343.50	2189.80	**	29.65	31.05	**
C16:1	643.57	652.42	ns	7.87	9.19	***
C18:0	402.28	348.63	**	5.37	4.91	*
C18:1 *trans*11	11.79	11.03	ns	0.15	0.16	ns
C18:1 n9*cis*	2447.89	2291.74	*	30.81	32.58	**
C18:1 n9*trans*	148.35	141.21	ns	1.88	2.03	*
C18:2 n6*cis*	783.22	573.26	**	10.42	8.42	***
C18:3 n6	489.02	250.10	***	5.80	3.52	***
*cis*9-*trans*11 CLA	36.16	39.54	*	0.43	0.56	**
*trans*10-*cis*12 CLA	4.96	5.70	*	0.06	0.09	**
*cis*9-*cis*11 CLA	5.71	5.05	ns	0.07	0.07	ns
SFA	3208.95	2925.31	**	40.71	41.63	*
MUFA	3357.86	3196.28	*	42.20	45.37	***
PUFA	1341.30	895.91	***	17.08	12.99	***
Total CLA	46.84	49.59	**	0.56	0.71	***
PUFA/SFA	0.42	0.31	**			
Total FA	7908.11	7017.50	**			

Significant differences. ns = $p>0.05$; * = $p<0.05$; ** = $p<0.01$; *** = $p<0.001$

Conclusions

CLA isomers content in meat from Burguete and HB foals' *diaphragm* muscle was similar to those obtained by other authors in sheep and cattle meat. That shows that horse, as pseudo-ruminant, can produce CLA from regular diets, and how breed and productions system can modify its concentration. Further research should be done to determine CLA concentration in commercial retails.

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