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POSTER

Fatty acid composition of adipose tissue in different anatomical locations of Iberian pigs

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Additional keywords
Carcass quality.

SUMMARY

Adipose tissue in animals is not homogeneously distributed throughout the body. It varies in composition depending both on fat-depot type and on feeding regime. The feeding regime implemented over the three months prior to slaughter can be identified by analysis of a subcutaneous fat (SF) sample taken at a point 10 cm from the tail insertion. However, research has not hitherto addressed fat composition at other anatomical locations. This study analyzed adipose tissue fatty-acid characteristics in the main fat depots in 20 Iberian pigs, 10 receiving compound feeds (Cf) and 10 reared solely under "montanera" extensive grazing (M). Fat samples were taken at 6 points: ham (H), loin (L), shoulder (S), belly (B), jowl (J) and kidney (K). Levels of the following fatty acids were measured: C16:0, C18:0, C18:1 and C18:2. Data were subjected to ANOVA and means were compared by Duncan test. No significant differences ($p>0.05$) between both feeding regimes were found for C18:2 content in H, L, S, B or J fat depots; the lowest values ($p<0.01$) were observed for K. No significant differences were found either for C16:0, C18:0 and C18:1 between the three dorsal areas. Values for C18:1 were significantly higher ($p>0.01$) for jowl fat (J) than for other fat depots under both feeding regimes.

Palabras clave adicionales
Calidad de canal.

Composición en ácidos grasos del tejido adiposo según la localización anatómica en el cerdo ibérico

RESUMEN

El tejido adiposo en los animales no es homogéneo y se distribuye por todo el cuerpo. Su composición es diferente según lo tipos de depósitos grasos y su composición varía, también, según el tipo de alimentación. El tipo de alimentación que recibe el animal durante los 3 meses anteriores al sacrificio, se puede conocer por la composición de una muestra de grasa subcutánea (SF), tomada a 10 cm de inserción del rabo. Sin embargo, no se ha realizado ningún trabajo sobre la composición de la grasa en otras zonas anatómicas. El objetivo es conocer las características lipídicas de la grasa de cerdo ibérico en sus principales zonas de deposición en el cuerpo del animal. Se utilizaron 20 animales, 10 alimentados con pienso compuesto (Cf) y 10 aprovechando exclusivamente la montanera (M). Las muestras de grasa se tomaron de 6 zonas: jamón (H), lomo (L), paleta (S), panceta (B), papada (J) y riñonada (K). Se determinó el contenido en los ácidos grasos C16:0, C18:0, C18:1 y C18:2. Los datos se analizaron mediante un ANOVA y la comparación de medias se realizó con un test de Duncan. No hubo diferencias ($P>0,05$) en C18:2, tanto en pienso como en montanera en las zonas de H, L, S, B o J; los menores valores ($P>0,01$) se obtuvieron para K. Los valores de C16:0, C18:8 y C18:1, en las tres zonas dorsales, no fueron significativamente diferentes ($P>0,05$). Los valores de 198:1 fueron significativamente más altos ($P>0,01$) de C18:1 en grasa de papada (J), en ambos regímenes alimenticios

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INTRODUCTION

The Iberian pig belongs to a group of native pig breeds found in the southern Iberian Peninsula since ancient times. The traditional rearing technique is based on the consumption of natural resources present in the production area known as "dehesa": acorns and pasture from October to April.

Robelin and Casteilla (1990, p. 247) reported that adipose tissue is the main storage from which energy

requirements are met. Adipose tissue is present both externally in subcutaneous fat and internally in kidney fat inter- and intramuscular fat. Oleic (C18:1), stearic (C18:0), palmitic (C16:0) and linoleic acid (C18:2) are the main fatty acids in adipose tissue of pigs. (De Pedro 2001, p. 592).

De Pedro (2001, p. 592) observed that the more the pigs were fed with compound feeds, the more the saturated fatty acid content (palmitic and stearic) of carcass fat tissue increased, whereas acorn consumption was associated with a gradual increase in unsaturated fatty acid levels.

Adipose tissue composition has also been found to vary as a function of tissue location within the carcass (Wood et al. 1986, p. 79; Franco et al. 2006, p. 794; Monziols et al. 2007, p. 57; Domínguez et al. 2015, p. 106)

It is important to determine the composition of fat depots, since this influences the organoleptic and technological properties of products made with Iberian pork fat, and to distinguish between feeding regimes implemented over the months prior to slaughter.

The present study aimed at determining potential differences in fatty acid composition among various anatomical sites of Iberian pigs

Material and Methods

A total of 20 Iberian pigs were used for this study; 10 were reared under a "montanera" regime (M), consuming only acorns and pasture during the months prior to slaughter, while the other 10 received compound feed until slaughter (Cf). After slaughter, adipose tissue samples were taken at 6 points on the carcass, as shown in Figure 1: ham (H), loin (L), shoulder (S), belly (B), jowl (J) and kidney (K).

Fat was extracted using a microwave oven (De Pedro et al. 1997) and the main fatty acids were measured by near-infrared spectroscopy (NIRS), according to methodology described by García-Olmo et al. 2000, p. 193). Fatty-acid composition of samples from different anatomical points was subjected to an analysis of variance (ANOVA) using the General Linear Model procedure of the computer programme SAS (2009) to determine the overall effect of the location and diet on fatty acid content. The multiple comparison of means was performed using a Duncan analysis.

Finally, we were able to obtain prediction equations of the main fatty acids deposition in the analysed fat depots using simple linear regression models. Data of the compositional traits were analyzed using the following mixed model:

$$Y_{ijk} = \mu + F_i + L_j + F_iL_j + e_{ijk}$$

Where μ is the trait value obtained in the ij location of the k animal; F_i is the fixed effect of i diet (i = 1 for montanera and i=2 for compound feeds); L_j is the fixed effect of j location (H=1, L=2, S=3, B=4, J=5, K=6); F_iL_j are the first-order interactions established between the main factors; + e_{ijk} is the residual random effect

RESULTS

The fatty-acid profiles of adipose tissue samples taken from various points on the carcass are shown in Table I. A clear difference is apparent between pigs reared under the Montanera regime over the last months prior to slaughter (M) and those receiving only compound feed (Cf); similar findings have been reported in other studies (De Pedro 2001, p. 592; Carrapiso et al. 2003, p. 625; Cava et al. 2000, p. 237).

Within each feeding regime, kidney fat composition differed clearly from that of other anatomical sites. The highest mean values were recorded for fatty acids C16:0 and C18:0, and the lowest for C18:1 and C18:2. In acorn-fed animals, however, kidney-fat composition in most cases did not differ significantly from that

Table I. Fatty acids composition of adipose tissue in different anatomical locations of Iberian pig carcass finished under two different systems (Composición del tejido adiposo de diversas zonas de la canal de cerdos ibéricos acabados en dos sistemas distintos).

	C16:0		C18:0		C18:1		C18:2	
Montanera	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Ham	21.40^{de}	0.65	9.33^{f}	0.41	55.16^{b}	1.21	7.74^{a}	0.21
Loin	21.48^{de}	0.59	9.58^{ef}	0.34	54.98^{b}	0.82	7.68^{a}	0.23
Shoulder	21.44^{de}	0.74	9.37^{f}	0.61	55.14^{b}	1.60	7.69^{a}	0.26
Belly	21.83^{d}	1.06	9.29^{f}	0.86	54.79^{b}	1.73	7.72^{a}	0.61
Jowl	20.63^{e}	0.48	8.25^{g}	0.47	56.82^{a}	0.88	7.95^{a}	0.22
Kidney	25.33^{b}	1.52	12.68^{b}	1.03	48.38^{de}	2.13	7.00^{b}	0.62
Compound feeds								
Ham	25.10^{b}	0.51	11.77^{cd}	0.47	48.65^{de}	0.96	7.72^{a}	0.58
Loin	25.78^{b}	0.76	12.03^{bcd}	0.78	47.63^{de}	1.40	7.77^{a}	0.44
Shoulder	25.90^{b}	0.74	12.25^{bc}	0.81	47.34^{e}	1.25	7.77^{a}	0.54
Belly	25.47^{b}	0.56	11.32^{d}	0.51	49.09^{d}	1.08	7.36^{ab}	0.31
Jowl	24.13^{c}	0.52	10.26^{e}	0.27	51.10^{c}	1.03	7.85^{a}	0.54
Kidney	27.63^{a}	0.62	14.00^{a}	0.51	45.07^{g}	1.25	6.42^{c}	0.66

Means in columns with different letters differed significantly (P<0.01).

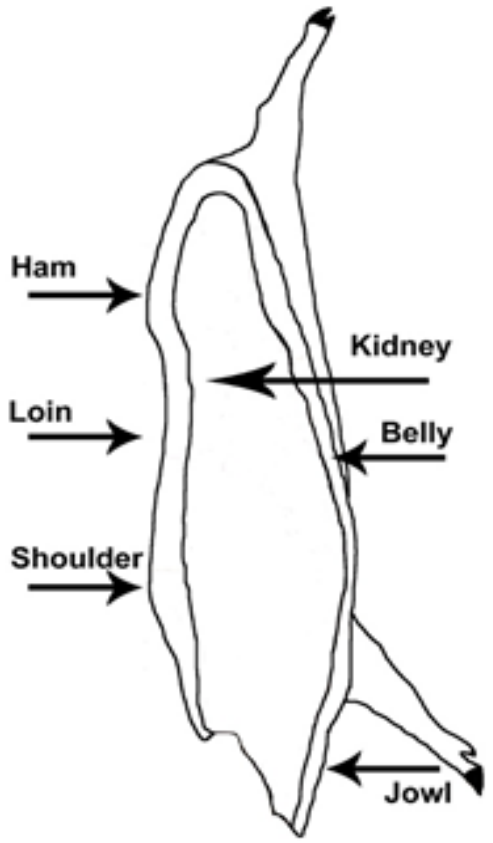

Figura 1. Zonas de la canal donde se cogieron las muestras de grasa (Carcass location where the fat samples were taken).

observed in ham, loin and shoulder samples from pigs reared on compound feed.

Regardless of feeding regime, jowl fat (J) displayed significant higher values ($P<0.01$) for oleic acid (C18:1).

DISCUSSION

As reported by various authors, (Wood et al. 1986, p. 79; Franco et al. 2006. p. 794; Monziols et al. 2007, p. 57; Domínguez et al. 2015, p. 106), feeding regime has a marked influence on fat composition in Iberian pigs, which also varies between anatomical sites. Given the absence of significant differences among backfat samples (loin, ham and shoulder), measurements aimed at distinguishing between feeding regimes in Iberian pigs can be made at any point on the carcass, thus facilitating sample-taking during quality control in the slaughterhouse.

The fatty-acid profile of jowl fat, marked by high oleic acid content, suggests that this anatomical area is well suited to manufacture products displaying healthier properties.

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