Archivos de Zootecnia
Journal website: https://www.uco.es/ucopress/az/index.php/az/
POSTER

Effect of slaughter age on the fatty acid profile of Celta pig breed

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Additional keywords
Nutritional value.
Fat quality.
Autochthonous breed.

SUMMARY

The Celta pig is an autochthonous breed from the NW of Spain, characterized by its rusticity and its adaptation to the environment, so these animals can be reared in extensive and semi-extensive regimen. The effect of slaughter age (12, 14 and 16 months) on the fatty acid profile of Celta pig breed was studied. For this study, the *longissimus dorsi* muscle from 45 barrows of Carballiña genotype was assessed. Statistical analysis displayed that the fatty acids most abundant were the monounsaturated fatty acids, which did not show significant (P>0.05) differences among slaughter ages. On the other hand, the saturated fatty acids content significantly (P<0.05) increased with the slaughter age (39.1 vs. 40.1 vs. 42.2%, for 12, 14 and 16 months, respectively). The polyunsaturated fatty acids content significantly (P<0.05) decreased with the slaughter age (12.0 vs. 10.1 vs. 7.5%, at 12, 14 and 16 months, respectively). In addition, the animals slaughtered at 16 months presented the lowest n-3 and n-6 fatty acid contents. Finally, the hypocholesterolemic/Hypercholesterolemic ratio significantly (P<0.05) decreased with the slaughter age (2.0 vs. 2.0 vs. 1.7, at 12, 14 and 16 months, respectively).

Efecto de la edad de sacrificio en el perfil de ácidos grasos de cerdos de raza Celta

Palabras clave adicionales
Valor nutricional.
Calidad de la grasa.
Raza autóctona.

RESUMEN

El cerdo Celta es una raza autóctona del noroeste de España, caracterizada por su rusticidad y su adaptación a las condiciones ambientales, por lo que pueden ser criados en régimen extensivo y semi-extensivo. Se estudió el efecto de la edad de sacrificio (12, 14 y 16 meses) en el perfil de ácidos grasos del cerdo Celta. Para este estudio fue usado el músculo *longissimus dorsi* de 45 machos castrados del genotipo Carballiña. El análisis estadístico revela que los ácidos grasos más abundantes fueron los monoinsaturados, los cuales no mostraron diferencias (P>0.05) entre las edades de sacrificio. El contenido en ácidos grasos saturados incrementó (P<0.05) con la edad de sacrificio (39.1 vs. 40.1 vs. 42.2%, para 12, 14 y 16 meses, respectivamente). La cantidad de ácidos grasos poliinsaturados disminuye (P<0.05) significativamente con la edad de sacrificio (12.0 vs. 10.1 vs. 7.5%, para 12, 14 y 16 meses, respectivamente). A mayores, los animales sacrificados a 16 meses presentaron los menores valores de ácidos grasos n-3 y n-6. Finalmente, el relación entre ácidos grasos hipocolesterolémicos/Hipercolesterolémicos disminuyó significativamente (P<0.05) con la edad de sacrificio (2.0 vs. 2.0 vs. 1.7, para 12, 14 y 16 meses, respectivamente).

Information
Cronología del artículo.
Recibido/Received: 03.01.2016
Aceptado/Accepted: 05.07.2017
On-line: 15.01.2018
Correspondencia a los autores/Contact e-mail:
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INTRODUCTION

The Celta pig is an autochthonous breed from the north-west of Spain, characterized by its rusticity and its adaptation to the environment. This breed is highly appreciated by consumers because of the succulent meat that results from the profuse infiltration of fat into the lean meat (Franco et al., 2014) and the production of these pigs is mainly focused on the manufacture of dry-ripened meat products such as ham (Bermúdez et al., 2012), "lacón" (Lorenzo et al., 2014), dry-cured loin (Pateiro et al., 2015) and sausages (Gómez and Lorenzo 2013; Fonseca et al., 2014). The aim of this study was to assess the influence of slaughter age on the fatty acid profile of Celta pig breed.

Table I. Effect of slaughter age on fatty acid composition (% of total fatty acids) and intramuscular fat content of *longissimus dorsi* (Efecto de la edad de sacrificio en la composición de ácidos grasos (% del total de ácidos grasos) y contenido de grasa intramuscular del músculo longissimus dorsi).

	Slaughter age (months)			SEM	P value
	12 m	14 m	16 m		
Loin IMF (g/100 g)	3.43±0.51^{a}	3.90±0.52^{ab}	4.18±0.49^{b}	0.07	0.040
Backfat thickness (cm)	3.97±0.91^{a}	6.00±0.58^{b}	6.26±0.69^{b}	0.17	0.001
Fatty acids					
C14:0	1.36±0.24^{a}	1.41±0.11^{a}	1.65±0.17^{b}	0.04	0.003
C16:0	26.16±3.15	26.01±1.65	28.14±1.41	0.43	0.073
C16:1 n-7	3.27±0.35^{a}	3.10±0.45^{a}	3.80±0.45^{b}	0.09	0.002
C17:0	0.14±0.06	0.12±0.07	0.14±0.05	0.01	0.81
C17:1	0.16±0.11	0.20±0.20	0.23±0.09	0.03	0.533
C18:0	11.43±1.12	12.19±1.22	12.09±1.24	0.22	0.311
C18:1 n-9	44.67±1.68	45.81±2.20	45.46±1.79	0.35	0.396
C18:2 n-6	10.36±2.82^{c}	8.10±1.22^{b}	6.05±1.00^{a}	0.46	0.001
C20:0	0.04±0.07^{a}	0.06±0.09^{a}	0.14±0.08^{b}	0.02	0.02
C20:1 n-9	0.75±0.15^{ab}	0.61±0.28^{a}	0.86±0.08^{b}	0.04	0.025
C18:3 n-3	0.78±0.39^{b}	0.77±0.26^{b}	0.38±0.05^{a}	0.06	0.004
C20:2 n-6	0.34±0.12^{b}	0.30±0.06^{b}	0.17±0.07^{a}	0.02	0.001
C20:3 n-3	0.14±0.05^{b}	0.07±0.05^{a}	0.22±0.08^{c}	0.02	0.001
C20:4 n-6	0.41±0.33^{a}	0.87±0.54^{b}	0.69±0.19^{ab}	0.08	0.038
SFA	39.13±3.34^{a}	40.13±1.89^{ab}	42.15±2.65^{b}	0.53	0.044
MUFA	48.85±1.61	49.77±1.52	50.36±1.92	0.32	0.153
PUFA	12.03±2.99^{c}	10.11±1.16^{b}	7.49±1.24^{a}	0.49	0.001
Indices					
∑n-6/∑n-3	13.18±3.46	13.12±6.45	11.71±1.68	0.77	0.695
AI	0.52±0.09^{a}	0.53±0.05^{a}	0.60±0.06^{b}	0.01	0.026
TI	1.20±0.20^{a}	1.24±0.13^{ab}	1.38±0.15^{b}	0.03	0.049
h/H	2.03±0.34^{b}	1.98±0.23^{b}	1.74±0.17^{a}	0.05	0.036

IMF: intramuscular fat. $^{a-c}$ Means within the same row followed by different letters differ significantly (P<0.05). AI: Atherogenic index. TI: Thrombogenic index. h/H: hypocholesterolemic/Hypercholesterolemic ratio.

MATERIAL AND METHODS

Experimental design and animal management

For this study, 45 castrated male pigs from the Celta breed (Carballina line) were used. All animals were reared in a single group in an extensive system. They were fed *ad libitum* with commercial concentrate suited to the nutritive needs of the animals. The animals were slaughter at 12, 14 and 16 months. At 45 min *post-mortem*, the dorsal fat thickness was measured with a flexible tape at the level of the first rib. Carcasses were chilled at 4°C in a cold chamber for 24 h. At this point, *longissimus dorsi* muscle (between the fourth and tenth rib) was extracted from the right side of each carcass.

Fat content and fatty acid analysis

Intramuscular fat content from loin (IMF) was quantified according to the ISO 1443 (1979), while for the fatty acids determination, the intramuscular fat was extracted according to Folch et al. (1957). Fifty mg of lipids were trans-esterified with a solution of boron trifluoride (14%) in methanol (Carreau & Dubacq, 1978). Separation and quantification of the FAMEs was carried out using a gas chromatograph as proposed by Domínguez et al. (2015b). Data were expressed in g/100 g of FAMEs. The atherogenic index (AI) and thrombogenic index (TI) were calculated according to Ulbricht & Sauthgate (1991), while the hypocholesterolemic/Hypercholesterolemic ratio (h/H) was calculated according to Fernández et al. (2007).

Statistical analysis

Data were evaluated by ANOVA mixed model using slaughter age as fixed effect and IMF content, backfat thickness and fatty acid profile as dependent variables. The pairwise differences between least-square means were evaluated by Duncan's method. All statistical analysis were performed using IBM SPSS Statistics 19 software (IBM Corp, 2010).

RESULTS AND DISCUSSION

Table I shows the influence of slaughter age on the loin IMF %, fatty acid profile and backfat thickness of Celta pigs. Pigs slaughtered at 16 and 14 months showed the highest values of backfat thickness and intramuscular fat when compared to animals slaughtered at 12 months. The IMF content agrees with results reported by Domínguez et al. (2014) (3.22-3.24 g/100g), Domínguez and Lorenzo (2014) (3.59 g/100g) and Domínguez et al. (2015a) (3.20-4.68 g/100g) in Celta pigs. Authors have shown the increase of these parameters with increasing slaughter age and/or slaughter weight (Lauridsen et al. 2005; Bosch et al. 2012). According to Lauridsen et al. (2005) this fact could be due to increasing slaughter age or weight also increase the deposition of fat and decrease the meat percentage.

Lipids of the intramuscular fat displayed that the older animals presented higher contents of saturated fatty acids (SFA) and lower percentages of polyunsaturated fatty acids (PUFA) than pigs slaughtered at 12 months. However, the content of MUFA was not affected by the slaughter age, although older animals presented slightly higher (P=0.153) values than younger. The fatty acids profile is in agreement with previously reported in Celta pig breed (Domínguez et al. 2014; Domínguez & Lorenzo, 2014; Franco et al. 2014; Domínguez et al. 2015a). Results obtained are in agreement with those reported by some authors (Raj et al. 2010; Bosch et al. 2012) who observed that the proportion of MUFA and SFA increased, while the PUFA content decreased with slaughter age increased. During the animals growth increase the energy available for the fat deposition, so that *de novo* synthesis is favoured (Raj et al. 2010). To this regard, it is well known that this synthesis causes an increase in the content of SFA and/or MUFA, while decreasing the values of the PUFA (Kloareg et al. 2005).

Finally, nutritional indexes are within the range described by some authors (Franci et al. 2005; Daza et al. 2008). The AI and TI indexes increased (P<0.05) whereas the h/H ratio decreased (P<0.05) as the slaughter age increased, Eventually, Σn6/Σn3 ratio did not vary with the slaughter age. The highest content of SFA observed in pigs slaughter at 16 months, and the highest percentages of PUFA found in pigs slaughter at 12 months caused the differences in these indexes.

CONCLUSIONS

As expected, intramuscular fat content and backfat thickness increased as slaughter age increase. Regarding fatty acids, PUFA content decreased, while SFA and MUFA increased as slaughter age increased. This fact may be due to as slaughter age increase as *de novo* synthesis increased and fatty acids from this synthesis exert a dilution effect on dietary fatty acids. As a general conclusion, the slaughter age has a great influence in intramuscular fat content and fatty acids composition.

ACKOWLEGMENTS

Authors are grateful to Xunta de Galicia (The Regional Government) (Project 09MRU013E) for the financial support and Jose M. Lorenzo is member of the MARCARNE network, funded by CYTED (ref. 116RT0503).

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