Effect of Breed and Feeding System on Fatty Acid Profile of Breast from Mos Corck Breed

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Abstract— **The effect of breed and feeding system on fatty acid profiles in cork was studied. A total of 50 Mos cork breed (25 feeding with concentrate (CM) and 25 feeding with corn (MM)) and 30 SATTO cork breed (15 feeding with concentrate (CC) and 15 feeding with corn (MC)) were used. As breed as feeding system showed significant differences respect to fatty acid composition. The breast meat fatty acids in this study are predominated by MUFA, following by SFA and PUFA for samples from MM, CC and CM batches, respectively, while samples from MC batch the main fatty acid were SFA. With regard to MUFA, your percentage increased with corn based diet and decreased in Mos breed. Within the MUFA, oleic acid ($C_{18:1cis9}$) was the most abundant. Concerning to SFA the predominant fatty acid was palmitic represented about 63%, 62%, 70% and 67% of total intramuscular SFA, for samples from MC, MM CC and CM groups, respectively, followed by $C_{18:0}$ and $C_{15:0}$. The PCA offered a good separation of the mean samples according to the breed and feeding system. The PC1 axis was mainly characterized by $C_{17:0}$, $C_{20:4}$, $C_{24:1}$, $C_{22:6}$, and W3 on the right side, and $C_{16:0}$ and W6/W3 on the left side. The variables that were positively aligned with PC2 were $C_{18:2}$, PUFA, W6 and P/S and were negatively related to $C_{18:1cis9}$ and MUFA. The variables positively aligned with PC3 were $C_{14:0}$ and $C_{18:3}$, while PC4 was positively related to SFA.**

Keywords— **Mos cork breed, Fatty acid profile, Feeding system**

I. INTRODUCTION

The production system, including slaughter weight, sex and different diets, is responsible for much of the variation in the fatty acid composition of meat [1].

The fatty acid composition of meat has long been studied because of its implications for human health. Due to the relationship between high-fat diets and heart disease, consumer interest in the fat content and fatty acid composition of foods has grown in recent years [2]. Nutritionists now recommend not only limiting fat intake but also consuming large amounts of PUFA, especially those of the *n-3* rather than the *n-6* PUFA [3].

Consumers often demand information regarding the nutrient composition of food and the quality of products consumed. Therefore, the aim of this study was to obtain data about the influence of breed and feeding system on fatty acid profile of breast from cock.

II. MATERIALS AND METHODS

A. Experimental design, animal management and sample collection

A total of 80 roosters (n=30 of Sasso T-44 line and n=50 of Mos breed) were used. They were separated by breed and allocated to two feeding treatment groups (concentrate and corn). Each feeding treatment group consisted of 15 and 25 roosters, for Sasso T-44 line and Mos breed, respectively. Birds were fed with a standard compound feed (ME: 13.19 MJ/kg, CP: 230 g/kg as fed basis, for more details see Table 1), provided by Piensos Biona (Lalin, Spain). All birds were

slaughtered in an accredited abattoir at 6 months by manual exsanguination, plucked and eviscerated. Carcasses were refrigerated for 24 hours at 4 ºC and then breast was excised.

B. Analysis of fatty acid methyl esters

Before analysis, intramuscular fat was extracted from 5 g of ground meat sample according to [4]. Lipid extracts were evaporated to dryness under vacuum at 35 °C and stored at -80 °C until analysis by preparation of fatty acid methyl esters (FAME´s). Lipids were transesterified with a solution of boron trifluoride (14%) in methanol, as described by [5]. Fifty milligrams of the extracted lipids were esterified and the FAME´s were stored at -80 °C until chromatographic analysis.

Separation and quantification of the fatty acid methyl esters was carried out using a gas chromatograph (GC, Agilent 6890N, Agilent Technologies Spain, S.L., Madrid, Spain) equipped with a flame ionization detector and an automatic sample injector HP 7683, and using a Supelco SPTM-2560 fused silica capillary column (100 m, 0.25 mm i.d., 0.2 μm film thickness, Supelco Inc, Bellefonte, PA, USA) according to chromatographic conditions described by [6].

III. RESULTS AND DISCUSSION

The fatty acid profile of breast muscle expressed as percentage by weight of the total identified fatty acids is shown in Table 1. As breed as feeding system showed significant differences respect to fatty acid composition. The breast meat fatty acids in this study are predominated by MUFA, following by SFA and PUFA for samples from MM, CC and CM batches, respectively, while samples from MC batch the main fatty acid were SFA. These results are in agreement with those reported by other authors for breast meat [7, 8] since MUFA were the most abundant of fatty acids.

With regard to MUFA, your percentage increased with corn based diet and decreased in Mos breed. Within the MUFA, oleic acid (C18:1*cis9*) was the most abundant, according with data reported by other authors [1, 8]. Oleic acid, is usually the main fatty acid present in meat and is formed from stearic acid (C18:0) by action of the estearoyl CoA desaturase enzyme (Wood et al., 2008). In our study MUFA content was a very significant ($r=0.99$, $p<0.01$, $r=0.95$, $p<0.01$, $r=0.89$, $p<0.01$, $r=0.99$, $p<0.01$; for Mos and commercial breed and corn diet and concentrate, respectively) correlation with C18:1*cis*-9 content and a less significant ($r=0.71$, $p<0.01$, $r=0.44$, $p<0.05$, $r=0.61$, $p<0.01$, $r=0.67$, $p<0.01$; for Mos and commercial breed and corn diet and concentrate, respectively) correlation with C16:1*cis*-9 content. The high MUFA percentage observed in breast meat hams indicates their suitability for healthier diets, since from a nutritional perspective, human diets rich in MUFA (and PUFA) decrease cholesterol levels in blood and are related to a low incidence of cardiovascular diseases [9].

Within the SFA the predominant fatty acid was palmitic represented about 63%, 62%, 70% and 67% of total intramuscular SFA, for samples from MC, MM CC and CM groups, respectively, followed by $C_{18:0}$ and $C_{15:0}$. These results in agreement with which showed similar proportions those reported by other authors [1]. Breast meat from CC group showed lesser percentage of SFA (33%) respect to breast meat from the other three groups (36.4%, 36.2% and 36.4% for MC, MM and CC groups, respectively). This major SFA content in breast meat samples from concentrate groups had a significant ($r = 0.38$, $P<0.05$) correlation with $C_{16:0}$ content and this is related with higher content of $C_{16:0}$ in the concentrate (34.99%) (see Table 1). This fact is important because nutritional guidelines recommend a lower intake of SFA and *trans* fatty acid (TFA) as well a higher PUFA intake (especially of *n*-3 family of PUFA to comply with an appropriate *n*-6/*n*-3 balance) in order to prevent cardiovascular diseases.

Concerning to PUFA content, the main *n*-6 fatty acid in all samples was $C_{18:2n\text{-}6}$. Breast meat samples from MC group showed the highest values (22.6%) and it was positive correlated ($r = 0.41$, $P<0.05$) with PUFA content. As a consequence, breast meat samples from MC group showed the highest proportion of total *n*-6 fatty acids among the four

groups analyzed. The major *n*-3 fatty acid was $C_{18:3n-3}$ for commercial cork, showed higher values in samples from corn (0.82 vs. 0.59) and $C_{22:6n-3}$ for Mos, observed higher values in samples from concentrate (0.58 vs. 0.51%). Concentrations of minority PUFA, such as C20:4n6 were higher in Mos class ($p<0.01$ and $p<0.001$, respectively), that suggested an upper ability of this chicken variety for the transformation of linoleic and linolenic acids in these polyunsaturated compounds, regardless of the employed diet.

Principal component analysis allows one to obtain a better overall idea of the relation between variables. In Figure 1 (a) and (b) the results of the first four principal components are plotted. The first two principle components (PC1 and PC2) showed the main structured information and explained 76.51% (54.05% and 22.46% respectively) of the variation between the samples. Adding two extra principal component increases this to about 96.18% explained variance. Figure 1(a) shows a clearly separation among breed (Mos and commercial). As can be seen, mean values "Mos" breed are at the negative side of PC1 and in the positive side of PC2, while mean values "Comercial" breed are at the positive side of PC1 and in the negative side of PC2. Figure 1(b) shows a clearly separation among feed system (cork and concentrate). As can be seen, mean values "Mos" breed are at the negative side of PC1 and in the positive side of PC2, while mean values "Comercial" breed are at the positive side of PC1 and in the negative side of PC2. Figure 1(b) shows a clearly separation among feed system (cork and concentrate). As can be seen, mean values "concentrate" feed system are at the positive side of PC3, while mean values "cork" feed system are at the negative side of PC3.

The PC1 axis was mainly characterized by C17:0, C20:4, C24:1, C22:6, and W3 on the right side, and C16:0 and W6/W3 on the left side. The variables that were positively aligned with PC2 were C18:2, PUFA, W6 and P/S and were negatively related to C18:1 and MUFA. The variables positively aligned with PC3 were C14:0 and C18:3, while PC4 was positively related to SFA.

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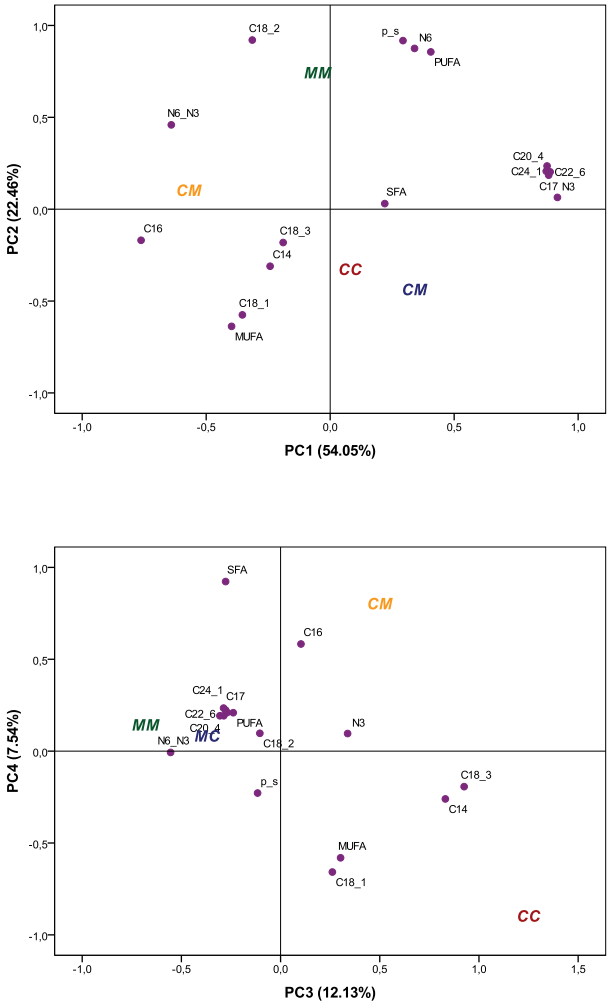

Figure 1 (a) and (b). Relationships among breed and finished diet and fatty acid profile obtained by PCA a) Projection of the variables and two breeds and two finished diets in the plane defined by the first two principal components b) Projection of the variables in the plane defined by PCs three and four.

Table 1. Effect of breed (Mos *vs.* Sasso T-44) and finishing feeding (corn *vs.* fodder) on fatty acid profile of breast

	Breed						SIG		SEM
	Mos (n=50)			**Commercial (n=30)**					
	Feed			**Feed**			Breed		
	Concentrate (n=25)	**Corn (n=25)**	SIG	**Concentrate (n=15)**	**Corn (n=15)**	SIG	**Concentrate (n=40)**	**Corn (n=40)**	
C14:0	0.44±0.11	0.58±0.12	***	0.83±0.08	1.03±0.17	***	***	***	0.01
C15:0	1.92±1.54	1.52±0.86	n.s.	1.15±0.33	0.90±0.42	n.s.	*	n.s.	0.11
C16:0	22.80±2.93	22.52±1.51	n.s.	25.50±2.20	22.01±1.14	***	n.s.	**	0.24
C16:1*cis*-9	1.50±0.53	1.88±0.78	n.s.	5.10±1.06	2.30±0.37	***	n.s.	***	0.08
C17:0	0.61±0.51	0.65±0.40	n.s.	0.34±0.10	0.30±0.18	n.s.	**	n.s.	0.04
C17:1*cis*-9	0.13±0.08	0.11±0.12	n.s.	0.13±0.04	0.00±0.00	***	n.s.	***	0.01
C18:0	10.58±1.52	10.90±1.44	n.s.	8.46±1.05	8.72±0.90	n.s.	***	***	0.15
C18:1*cis*-9	32.64±4.15	35.68±4.57	*	32.68±2.06	40.94±1.98	***	***	n.s.	0.42
C18:2*n*-6	22.62±2.88	19.10±1.72	***	20.72±1.74	18.85±1.85	**	n.s.	*	0.25
C20:1	0.25±0.05	0.34±0.10	***	0.28±0.04	0.34±0.06	**	n.s.	n.s.	0.08
C18:3*n*-3	0.37±0.10	0.48±0.10	**	0.59±0.07	0.82±0.19	***	***	***	0.01
C20:2	0.18±0.05	0.20±0.06	n.s.	0.12±0.04	0.14±0.05	n.s.	**	***	0.01
C20:3*n*-6	0.18±0.06	0.20±0.07	n.s.	0.22±0.04	0.19±0.04	n.s.	n.s.	*	0.01
C20:4*n*-6	4.37±3.30	4.49±1.80	n.s.	3.04±0.68	2.61±0.73	n.s.	***	n.s.	0.24
C24:1	0.76±0.40	0.80±0.34	n.s.	0.56±0.12	0.54±0.20	n.s.	*	n.s.	0.03
C22:6*n*-3	0.58±0.43	0.51±0.27	n.s.	0.28±0.11	0.24±0.13	n.s.	**	*	0.03
SFA	36.37±1.47	36.16±2.25	n.s.	36.24±2.09	32.98±1.51	***	***	n.s.	0.21
MUFA	35.31±4.24	38.83±4.69	**	38.74±2.73	44.13±2.02	***	***	**	0.44
PUFA	28.32±3.77	25.00±3.08	**	25.01±2.05	22.88±1.77	**	*	**	0.34
TUFA	63.62±1.47	63.84±2.25	n.s.	63.75±2.09	67.02±1.51	***	***	n.s.	0.21
Σ*n*-6	27.18±3.60	23.80±2.86	***	24.00±1.94	21.66±1.75	**	*	**	0.32
Σ*n*-3	0.94±0.37	1.01±0.25	n.s.	0.88±0.17	1.07±0.15	**	n.s.	n.s.	0.03
***n*-6/*n*-3**	31.16±8.88	24.52±4.13	**	28.18±4.68	20.56±3.07	***	**	n.s.	0.69
PUFA/SFA	0.77±0.10	0.69±0.06	**	0.69±0.07	0.69±0.07	n.s.	n.s.	**	0.01

Significance: *** ($p<0.001$), ** ($p<0.01$), * ($p<0.05$), n.s (not significative).

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