FAT QUALITY OF PIGS FROM DIFFERENT PRODUCTION SYSTEMS

L. Basso*[1], M.E. Cossu[1], S. Moisá[1], J. Brunori[2], D. Campagna[3], G. Alleva[1] and R. Franco[2]

[1] Animal Production Department, Faculty of Agronomy at the University of Buenos Aires, addressed at Av. San Martin 4453, zip code (1417), Buenos Aires, Argentina. [2] Pork Group, at E.E.A. INTA located in Marcos Juárez, Córdoba, Argentina. [3] Faculty of Agrarian Sciences at the National University of Rosario, Rosario, Argentina. Email: lbasso@agro.uba.ar

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Introduction

Alternatives exist to introduce factors of differentiation in meat production such as the production system and feeding. There are very few research works on the effects of outdoor systems on the quality of pork, in some cases with contradictory results due to the fact that there exists a great number of factors that influence them. (Gentry *et al.*, 2002). Thus, the exercise that pigs do when pasturing has a direct and indirect effect on said quality, by the reduction of the growing speed, less consumption of supplementary food and the change in the proportions of the different types of muscular fibres (Stoll, 1992).

On the other hand, the quality of adipose tissue as regards its nutritional value, organoleptic and conserving properties, is related to the composition in fatty acids (Lizardo *et al.*, 2002). Furthermore, its composition is highly influenced by different factors, such as the genotype, sex, age, live weight and fattening grade of pigs (Girard *et al.*, 1988; Lebret and Mourot, 1998), the place of deposition (Marchello *et al.*, 1983; Miller *et al.*, 1990), the thermic environment (Katsumata *et al.*, 1995) and especially by nutrition. The energy and the content of lipids in the diet, its composition in fatty acids, the daily consumption of food and the division of energy between protein and lipids in the animal body may modify the composition of fatty acids of the adipose tissue. (Wiseman *et al.*, 1998, Lebret and Mourot, 1998).

The purpose of the experimental work is to assess the effect of the supplement with high quality pastures and the exercise done by the animals during growth and finishing in outdoor systems on the intramuscular fat, the quality of pork and its nutritious properties.

Materials and Methods

A summer-autumn trial was conducted at Experimental Station INTA Marcos Juárez and the Meat Quality Laboratory of the Agronomy Faculty at the University of Buenos Aires. Fifty four pigs INTA-MGC were used (27 barrows and 27 gilts), with an initial average weight of 26.4 ± 0.7 kg, aleatory distributed in three treatments: T1: pigs in outdoor conditions on a 1.4 ha lot, in a pasture with alfalfa (*Medicago sativa*) and white clover (*Trifolium repens*); T2: pigs in outdoor conditions on a 1.4 ha lot with no implanted pasture and with a coverage of cebadilla (*Bromus unioloides*); T3: pigs in indoor conditions located in stall with concrete floor. The pigs were fed ad-libitum with standard feed from 25 to 60 kg of live weight (DE: 3.30 Mcal/kg, CP: 18%, Lysine: 1.05%) and from 60 to slaughter (111.6 ± 7.09 kg) with finishing diet (DE: 3.28 Mcal/kg, CP: 17.5%, Lysine 1.0%) on a maize and soya basis. After slaughter samples of *Longissimus dorsi* muscle (last rib level) were obtained to determine composition in fatty acids from intramuscular fat, extracted according to Folch *et al.* (1957) and analysed by gas chromatography (Shimadzu GC-14B; capillary column: Ulbon HR-SS-10; 0.32 I.D.x 50 mL) and using helium as carrier gas. For the variables analysed, GLM procedure of SAS (SAS, 1998) was used and mean values were compared using Tukey test with a 5% significance.

Results and Discussion

The growing-finishing pig in outdoor systems and pasture produced better pork quality than traditional indoor systems, along with more favourable health characteristics. Fatty acid composition presented significantly more C18:1 and C18:3 ($p<0.05$; Table 1). The level of C18:3 increased by high quality pasture consume, with relation to the treatment without pasture and on concrete, probably due to the fact that pastures are characterized by a high level content of polyunsaturated fatty acids and mainly of C18:3 (more than 50% of the total fatty acids), as well as n-6/n-3 ratio of 0.20 (Morand-Fehr and Tran, 2001). The lower level content of polyunsaturated fatty acids was due to the C18:2 level (9.83% and 7.26% for indoor-concrete and outdoor-pasture group respectively) ($p<0.05$). This explains the low n-6/n-3 ratio for pasture group (12.77), which is nearest to the recommendation of the U.S. Department of Health (4,0).

Conclusions

The results of this study show a good response of pasture inclusion and outdoor conditions on intramuscular fat quality. Pasture group showed high oleic and linolenic acid content and a better n-6/n-3 ratio.

Table 1: Least-squares means and residual standard deviation (RSD) of fatty acids composition of intramuscular fat of different treatment.

Fatty acids	Outdoor		Indoor	RSD
	Pasture	Non pasture		
C16:0	24.58	24.60	25.15	0.76
C16:1	3.59	3.25	3.16	0.56
C18:0	12.07	12.32	12.34	1.04
C18:1	43.27 *a*	42.81 *a*	40.73 *b*	1.90
C18:2	7.26 *b*	8.56 *ab*	9.83 *a*	1.51
C18:3	0.58 *a*	0.34 *b*	0.25 *b*	0.17
SFA	40.15	39.50	41.00	1.46
MUFA	49.80 *a*	48.66 *ab*	46.69 *b*	2.07
PUFA	10.05 *b*	11.84 *a*	12.30 *a*	1.51
n-6/n-3	12.77 *b*	24.21 *a*	30.30 *a*	2.45

SFA: saturated fatty acids; MUFA: monounsaturated fatty acids; PUFA: Polyunsaturated fatty acids. Different letters indicate significant differences ($p<0.05$).

References

Folch, J., Lees, M. and Stanley, G.H.S. (1957). A simple method for the isolation and purification of lipids from animal tissues. J. of Biological Chemistry, 226: 497-509.

Gentry, J.G., McGlone, J.J., Blanton J.R. and Miller, M.F. (2002). Alternative housing systems for pigs: Influences on growth, composition and pork quality. J. Animal Science 80: 1781-1790.

Girard, J.P., Bout, J. and Salort, D. (1988). Lipides et qualités des tissus adipeux et musculaires de porc, facteurs de variation. I. Lipides et qualités des tissus adipeux, facteurs de variation. II. Lipides et qualités des tissus musculaires, facteurs de variation. Journéss Rech. Porcine France 20, 255-278.

Katsumata, M., Hirose,I. and Kaji, Y. (1995). Influence of high ambient temperature and dietary fat suppementation on fatty acid composition of depot fats in finishing pigs. Anim. Sci. Technol. (Jpn) 66, 225 - 232.

Lebret, B. and Mourot, J. (1998). Caractéristiques et qualité des tissus adipeux chez le porc. Facteurs de variation non génétiques. INRA. Prod. Anim. 11, 131-143.

Lizardo, R., van Milgen, J., Mourot, J., Noblet, J. and Bonneau, M. (2002). A nutritional model of fatty acid composition in the growing-finishing pig. Livestock Production Science 75, 167-182.

Marchello, M.J., Cook, N.K., Slanger, W.D., Johnson, V.K., Fischer, A.G. and Disusson, W.E. (1983). Fatty acid composition of lean and fat tissue of swine fed varius dietary levels of sunflower seed. Journal of Food Science 48, 1331-1334.

Miller, I.J., Shackelford, S.D., Hayden, K.D. and Reagan, J.O. (1990). Determination of the alteration in fatty acid profiles, sensory characteristics and carcass traits of swine fed elevated levels of monounsaturated fats in the diet. J. Animal Science 68, 1624-1631

Morand-Fehr, P., Tran, G. (2001). La fraction lipidique des aliments et les corps utilisés en alimentation animale. INRA Prod. Anim. 14 (5): 285-302.

SAS. (1998). SAS Users Guide: Statistics. SAS Institute Inc., Cary, NC (USA).

Stoll, P. (1992). Comparaison de différents modes d'engraissement du porc. I. Comportement au pâturage, performances d'engraissement et d'abattage. Revue Suisse Agric. 24(6): 381-385.

Wiseman, J. and Agunbiade, J.A. (1998). The influence of changes in dietary fat and oils on fatty acid profiles of carcass fat in finishing pigs. Livestock Production Science 54, 215-225.