# EFFECT OF DIET AND INTAKE LEVEL DURING GROWING AND FATTENING, ON THE CHARACTERISTICS OF MUSCLE AND SUBCUTANEOUS FAT OF IBERIAN PIGS

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S-IVA.14

SUMMARY

Intake level affected differently the fatty acid composition of subcutaneous fat, according to the fattening diet used. Pigs restricted 'N-30' during growing and then finished on acorns, had higher amount of C18:1 (52,7 vs 50,0) and lower amount of C18.:2 (10,8 vs 12,1). Animals fattened with a commercial diet had lower content of C16:0 (20,1 vs 21,0) and higher of C18:2 (16,62 vs 15,25). The diet did not affect the muscle traits, pH24, Water Hold Capacity, Colour attributes L* a* b* and Shear Force. However, the Hue* value of subcutaneous (SC) fat tissue was higher (P<0,001 ) in pigs fed on acorns (88,2 vs 81,7). Fatty acid composition of both intramuscular (IM) and subcutaneous (SC) fat were largely influenced by the diet. Pigs fattened with acorns had higher content of C18:1 (IMF = 51,9 vs 49,3; P < 0,01 ; SCF= 51,4 vs 44,6; P < 0,001) and lower content of C18:2 ( IMF=5,5 vs 6,7; P < 0,05 SCF=11,8 vs 15,9; P < 0,001).

## Introduction

Iberian pig is a local breed exploited under an agro-silvo-pastoral system dominated by the Mediterranean forest (green oak and cork oak). After a long growing period, during Spring and Summer, frequently with insufficient nutritionally requirements supply, the Iberian pigs are fattened during the Autumn and Winter by pasturing the acorns and grass under the oak canopy and then slaughtered on January. Genotype and nutrition seem to be fundamental to get adequate raw material for the obtention of traditional home dry products, namely for a special high quality and high value non-smoked ham. According to Monin (1988) high quality meat products require raw materials with well defined technological and organoleptical characteristics.

Several studies (Brooks, 1971; Villegas et al., 1973; Marchello et al., 1983; Wood et al., 1986) suggest that pig fat composition could be largely manipulated by fatty acid content of the diet and the feeding system. On the other hand, from the studies of models for growth, there is some virtue in asserting that protein deposition has priority over fat deposition (Lindsay, 1983). According to Eekhout et al. (1984) for a given live weight and a given protein accretion, the amount of lipid accretion depends entirely on ME intake; so, the restriction during the growing period may result in differences on carcass composition and in muscle and fat characteristics.

The objective of this work was to study the effect of both feed restriction during the growing period (on the traditional production cycle) and the type of diet during the fattening period on muscle and fat characteristics.

## Materials and methods

### Animals and feed regimes

16 growing pigs with 40 Kg live weight, five months old, were randomly divided into two groups, eight animals per group. Sex was neutralized by castration, at an early age. One group 'N' was fed a commercial diet containing 17% CP and 3150 Kcal DE according to a normal increase scale of feeding (INRA, 1987). The other group 'N-30' was fed the same diet but restricted by 30 %. At the end of the growing period, 4 animals of each group were fattened by pasturing on the woodland (acorns + grass) and the remaining animals, fed a commercial diet. All pigs were slaughtered at 115 Kg L.W..

Samples

Muscle samples were taken from *Biceps femoris, Semimembranosus* and *Longissimus Dorsi* and subcutaneous fat samples from dorsal (at the level of the last rib) and ham regions. Both outer and inner layers were analyzed. Samples were vacuum packaged and stored at - 20°C until they were analyzed.

**Analytical procedures**

Muscle samples were analyzed for: moisture (IN ISO - 1442), total protein (IN ISO - 937), neutral and polar intramuscular fat percentage (Maxwell et al., 1981), color (Minolta CR-200; CIE L* a* b*), Water Holding Capacity (results are expressed in water lost percentage of product) (Goutemfongea, 1969), shear force (Warner - Bratzler) and $pH_{24}$.

Subcutaneous fat samples were analyzed for moisture (IN ISO - 1442), total protein (IN ISO - 937), total lipids determined by = 100 - (moisture + protein), lipid extract (Folch et al., 1957); and color (Minolta CR-200; CIE L* a* b*).

Lipids from all fat samples were later prepared to obtain the methyl esters (Bannon et al., 1985) and analyzed by gas chromatography.

ANOVA was carried out for the effect of intake level and diet fed, using a package of the Statgraphics Statistical Graphics System 5.0. Means comparasion was carried out by using the LSD test.

**Results and discussion**

Tables 2 and 4 present the results for the effect of respectively intake level and diet on muscle characteristics. The values are averages of the three muscles sampled. Tables 3 and 5 present the results concerning to subcutaneous fat characteristics. Values are averages of samples from backfat and ham subcutaneous fat.

**Effect of intake level during growing**

Muscle characteristics were not significantly affected by feed restriction (Table 2).
The gross chemical composition of subcutaneous fat (water, lipids and FFDM) was not affected by feed restriction during growing (Tables 3). Althougt the fatty acid composition has been affected significantly by the intake level, it depended on fattening diet used.

Pigs restricted by 30 % during growing and then fattened on acorns presented lower amounts of C14:0 ($P<0,001$), C16:1 ($P<0,05$), C18:2 ($P<0,001$) and C18:3 (P0,01) and a higher amount of C18:1 ($P<0,001$) than those not restricted. The higher amount of C18:1 found in the 'N-30% + acorn' samples were probably determined by the acorn intake (pigs N-30% gained more 20 Kg L.W. on acorns- see experimental scheme). The amount of C18:1 in acorn is about 61% (Table 1). On the other hand fat of 'N-30' pigs had lower level of C18:2. This fatty acid can not be synthezised by mammals. A fixed proportion of dietary C18:2 is incorporated into fat tissue whatever the dietary intake (about 400mg/g dietary C18:2) (Wood, 1983). Thus, higher intake of acorn will result in lower C18:2 deposition due to a dilution effect.

'N-30%' pigs fattened with the commercial diet had a lower amount of C16:0 ($P<0,05$) and a higher amount of C18:2 ($P<0,001$).

Traditional feed restriction during growing period, imposed by climatic conditions, affects the characteristics of fat, mainly if pigs are fattened later on acorns.

**Effect of diet**

Muscle chemical composition and technological traits were not significantly affected by diet (table 4). The fatty acid composition of intramuscular fat (IM) in 'acorn' pigs presented higher amount of C18:1 ($P<0,01$ N; $P<0,001$ N-30%) and a lower amount of C18:2 (ns N; $P<0,05$ N-30%) than in commercial pigs (Table 5). The major saturated fatty acids C16:0 and C18:0 of the IM fat remained almost constant, which agrees with a previous reports of Greer et al. (1965).

Subcutaneous fat (SC) of 'acorn' pigs presented less water content ($P<0,05$ for N and N-30%) and higher lipid concentration ($P<0,05$ for N and N-30%) (Table 5). This higher lipid concentration, at the same slaughtered weight, could be related (1) to the extraordinary collect capacity and appetence for acorns, demonstrated by the Iberian pig (allowing a high intake energy level and (2) to the different chemical composition of the diets, namely in their lipid content (table 1). Metz (1980) reported an increase in fat content

in backfat, due to a higher level of daily energy intake and Wilde (1983) observed an increase in backfat thickness and lipid content in pigs fed with supplement fat.

The diet effect on SC fat color attributes was not clear. However, pigs fattened with commercial feed presented significantly higher a* value and lower hue* in 'N-30%', what could be related to different levels of pigment deposition.

The unsaturated fatty acids of SC were clearly affected by the diet. 'Acorn' pigs presented higher amount of C18:1 and lower amount of C18:2. Brooks (1971) pointed out that the type and fat level cause the greatest significant differences of fat composition. Wilde (1983) observed that the dietary fat supplementation influenced the carcass fat composition by decreasing "endogenous" fat synthesis and by increasing the deposition of the dietary fat into fatty tissues. The differences found in this study can be a resultant of the relative amounts of C18:1 and C18:2 presented in acorns and commercial feed, and also of the differences in fat content between both diets (table 1).

C18:0 and C16:0 were not affected by the diet. It is possible that the content on these fatty acids have been determined in some extent by fat 'endogenous' synthesis.

**Conclusions**

Diet affected significantly the gross chemical fat composition (water, lipids and FFDM) of subcutaneous fat, and greatly the fatty acids composition.

Intake level during the growing period played an important role on the effect of the fattening diet.

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