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# Effects of dietary fat saturation on fatty acid composition and gene transcription in different tissues of Iberian pigs

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ABSTRACT

The effect of two diets, respectively enriched with SFA (*S*) and PUFA (*P*), on FA tissue composition and gene expression was studied in fattened Iberian pigs. The FA composition of adipose, muscular and liver tissues was affected by dietary treatment. *S* group showed higher MUFA and MUFA/SFA ratio and lower PUFA and $n-6/n-3$ ratio than *P* group in all analyzed tissues. In muscle and liver the extracted lipids were separated into neutral lipids and polar lipid fractions which showed significantly different responses to the dietary treatment, especially in liver where no significant effect of diet was observed in NL fraction. The expression of six candidate genes related to lipogenesis and FA oxidation was analyzed by qPCR. In liver, *stearoyl CoA desaturase (SCD)*, *acetyl CoA carboxylase alpha (ACACA)* and *malic enzyme 1* (*ME1)* genes showed higher expression in *S* group. *SCD*, *ACACA*, *ME1*, and *fatty acid synthase (FASN)* gene expression levels showed a wide variation across the tested tissues, with much higher expression levels observed in adipose tissue than other tissues. Tissue FA profile and gene expression results support the deposition of dietary FA, the lipogenic effect of dietary saturated fat in liver and the employment of saturated dietary fat for endogenous synthesis of MUFA in all the analyzed tissues.



## 1. Introduction

Besides fat quantity, fatty acid (FA) composition of muscle and adipose tissues determines sensorial, technological and nutritional aspects of meat influencing its perception by the consumers (Webb & O'Neill, 2008; Wood et al., 2008). From a nutritional point of view, medical recommendations are now shifting from the reduction of fat intake towards increasing fat quality in order to maintain cardiovascular health. Meat is a primary source of dietary fat and especially of saturated fatty acids (SFA). High consumption of SFA has been associated with obesity, high plasma cholesterol and cardiovascular diseases (Chizzolini, Zanardi, Dorigoni, & Ghidini, 1999; Katan, Zock, & Mensink, 1994), while replacing SFA with MUFA or PUFA reduces the risk of coronary heart disease (de Lorgeril & Salen, 2012). At the same time, long-chain polyunsaturated fatty acids (PUFA) have been implicated in the prevention of different diseases (Nguyen, Nuijens, Everts, Salden, & Beynen, 2003; Wood et al., 2003), although nutritionists tend to focus more on the PUFA/SFA ratio and the ratio $n-6/n-3$ rather than the content of particular FAs (Jimenez-Colmenero, Ventanas, & Toldra, 2010). Although producers and consumers differ about the importance of animal FA profile in meat quality (Webb & O'Neill, 2008), an increasing number of consumers prefer meat products with higher ratios of PUFA and MUFA relative to SFA and with favorable balance between $n-6$ and $n-3$ PUFA, because of their beneficial effects on disease prevention (Kallas, Realini, & Gil, 2014; Wood et al., 2003). Hence, there has been much interest in finding ways to manipulate the FA composition of meat in order to produce functional foods (Coates, Sioutis, Buckley, & Howe, 2009). Different aspects such as feeding system, age, sex or the genetic type influence this composition, dietary manipulation of the FA profile being the most effective procedure of altering the fat composition of pig meat products (Kouba, Enser, Whittington, Nute, & Wood, 2003; Morel, McIntosh, & Janz, 2006).

In monogastric meat animal species most dietary fatty acids are absorbed directly, unchanged from the intestine (Enser, Richardson, Wood, Gill, & Sheard, 2000), and deposited in muscle and adipose tissues. Moreover, tissue fatty acid composition is also dependent on endogenous synthesis which may be also influenced by dietary composition. Changes in dietary fat have different impacts on the expression of genes related to lipid metabolism (Jump et al., 2005). Most studies have been performed in rodents, in which PUFA and SFA enriched diets have been shown to alter the transcription of genes related to

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