EFFECT of SUPPLEMENTATION of LINSEED or CHIA SEED on ADIPOSE TISSUE DEVELOPMENT, FATTY ACID COMPOSITION and LIPOGENIC GENE EXPRESSION of LAMBS

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INTRODUCTION

Conjugated linoleic acid (CLA) and n-3 long chain polyunsaturated fatty acids (LCPUFA) have potential health benefits. Then, there is interest in increasing its content in meat using feeding strategies such as addition in the diets of feeds with a high content of a-linolenic acid (ALA) like linseed.

Nevertheless, it has been shown that although linseed addition increased the proportions of ALA and vaccenic acid (VA) in adipose tissue (AT) in ruminants, LCPUFA and 9c11t-CLA (catalyzed from ALA and VA, respectively) remained unchanged. This fact was probably due to the inhibitory effects of n-3 PUFA on expression of genes involved in PUFA synthesis.

On the other hand, chia seed (*Salvia hispanica L.*) has also gained attention as a rich source of ALA and therefore, it could be an alternative source for enrichment of lamb meat in healthy fatty acids.

PURPOSE

The purpose of this study was to evaluate the effect of the inclusion in the diet of linseed or chia seed on growth and carcass parameters, fatty acid profile and gene expression of key-lipogenic enzymes in subcutaneous (SC) and intramuscular (IM) AT in lambs.

MATERIAL AND METHODS

- **Animals: 31 male *Navarra* breed lambs**

Weaning (16-17 kg LW) →

- **C** group (control), *n* = 9: barley + soya
- **L** group, *n* = 11: barley + soya + 10% linseed
- **Chia** group, *n* = 11: barley + soya + 10% chia seed

→ Slaughter (26-27 kg LW)

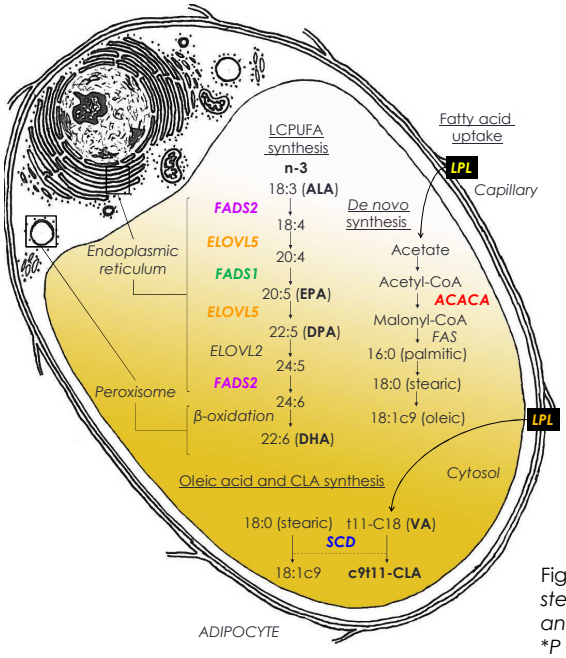
Subcutaneous adipose tissue — *Longissimus dorsi muscle*

- **Fatty acid composition: chromatography**
  - ✓ Statistical analysis: ANOVA
- **Gene expression: qPCR (ΔΔCt Method)**
  - ✓ Housekeeping (*β-Actin*), calibrator (C group)
  - ✓ Statistical analysis: Rest © Algorithm

RESULTS

Growth, carcass and fatness parameters

There were not significant differences in slaughter weight, average daily gain, carcass weight, backfat thickness and the amount of perirenal fat among three groups.



Fatty acid composition

Table 1. Subcutaneous (SC) and intramuscular (IM) adipose tissue fatty acid composition.

	C	L	Chia	P-value	C	L	Chia	P-value
	SC				IM			
C18:1t11 (VA)	8.27^{b}	13.26^{a}	11.72^{ab}	0.006	3.79^{b}	6.65^{a}	5.57^{a}	0.001
C18:3n3 (ALA)	0.45^{b}	1.39^{a}	1.26^{a}	<0.001	0.53^{b}	1.84^{a}	1.73^{a}	<0.001
CLA	0.58	0.55	0.66	0.348	0.43	0.45	0.47	0.546
C20:5n3 (EPA)	0.02^{b}	0.04^{a}	0.04^{a}	<0.001	0.19^{b}	0.42^{a}	0.36^{a}	<0.001
C22:5n3 (DPA)	0.06^{c}	0.11^{a}	0.09^{b}	<0.001	0.42^{b}	0.60^{a}	0.54^{ab}	0.006
C22:6n3 (DHA)	0.02	0.02	0.02	0.133	0.12	0.15	0.15	0.309

^{a,b,c} *Significant differences (P < 0.05) between C and L or Chia groups.*

Gene expression

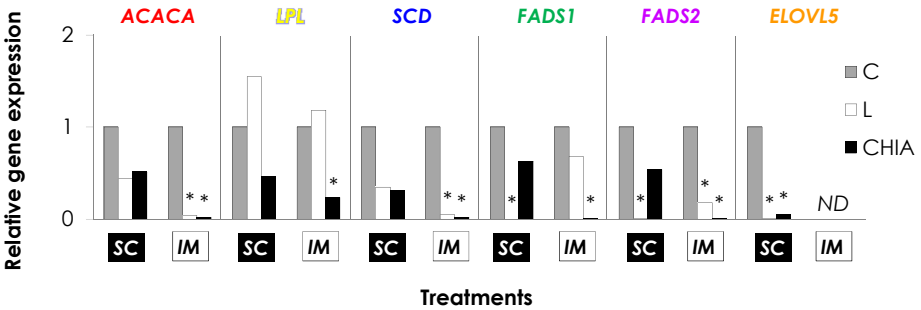


Figure 1. Relative gene expression of *acetyl-CoA carboxilase (ACACA), lipoprotein lipase (LPL), stearoyl-CoA desaturase (SCD), fatty acid desaturase 1 (FADS1), fatty acid desaturase 2 (FADS2) and fatty acid elongase 5 (ELOVL5)* in subcutaneous (SC) and intramuscular (IM) adipose tissues. *P < 0.05. *ND* = Not detected.

CONCLUSIONS

- **The inclusion in the diet of linseed or chia seed did not cause any effect on growth, carcass and fatness parameters of lambs.**
- **Addition of both linseed or chia seed resulted in a similar fatty acid composition of SC and IM AT of lambs, causing an increase in health-beneficial ALA, VA, EPA and DPA contents compared with control group, however, CLA and DHA contents remained unchanged.**
- **It was suggested that dietary manipulation of fatty acid composition is mediated, at least partly, through the regulation of some lipogenic genes, causing both linseed or chia seed a similar regulation (*ACACA*, *SCD*, *ELOVL5*) in SC and IM AT.**
  - ✓ **The lower *SCD* gene expression in IM AT of lambs could be caused to PUFA inhibitory effect, considering that although there was an increase of VA, the content of 9c11t-CLA did not change.**
  - ✓ **The desaturation/elongation of n-3 LCPUFA seems to be blocked at the level of DPA, which was probably due to the inhibition of enzymes involved in LCPUFA synthesis.**