Jornadas Med 2019
Mediterranean Institute for Agriculture, Environment and Development

Lipid oxidation in lamb meat enriched in polyunsaturated fatty acids

ANIMAL PRODUCTION AND HEALTH

D. Soldado[1], L. Fialho[1], A. Francisco[2,3], B. Grafanhante[4], A. P. Portugal[2], S. Alves[3,4], R. Bessa[3,4], J. Santos-Silva[2,3], E. Jerónimo[1,5]

[1] Centro de Biotecnologia Agrícola e Agro-Alimentar do Alentejo (CEBAL) / Instituto Politécnico de Beja (IPBeja), 7801-908 Beja, Portugal
[2] Instituto Nacional de Investigação Agrária e Veterinária, Pólo Investigação da Fonte Boa, 2005-048 Vale de Santarém, Portugal
[3] Centro de Investigação Interdisciplinar em Sanidade Animal (CIISA), Avenida da Universidade Técnica 1300-477 Lisboa, Portugal
[4] Faculdade de Medicina Veterinária, Universidade de Lisboa, Avenida da Universidade Técnica, 1300-477 Lisboa, Portugal
[5] ICAAM - Instituto de Ciências Agrárias e Ambientais Mediterrânicas, Universidade de Évora, Pólo da Mitra, Ap. 94, 7006-554 Évora, Portugal

david.soldado@cebal.pt | eliana.jeronimo@cebal.pt | **https://projects.iniav.pt/valrumeat/**

Introduction

→ Consumption of polyunsaturated fatty acids (PUFA) has been considered as favorable to human health, which has motivated an extensive research in order to enhance PUFA levels in ruminant products.

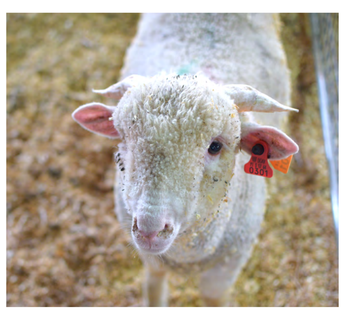
→ Supplementation of diets with PUFA-rich lipid sources is used to increase PUFA levels in ruminant meat. However, PUFA are highly prone to oxidation, which may compromise the meat quality.

Aim

Evaluate the impact of dietary supplementation with PUFA-rich lipid sources with different degrees of unsaturation on lipid oxidation of meat and the efficacy of α-tocopherol supplementation, in six productive experiments with lambs

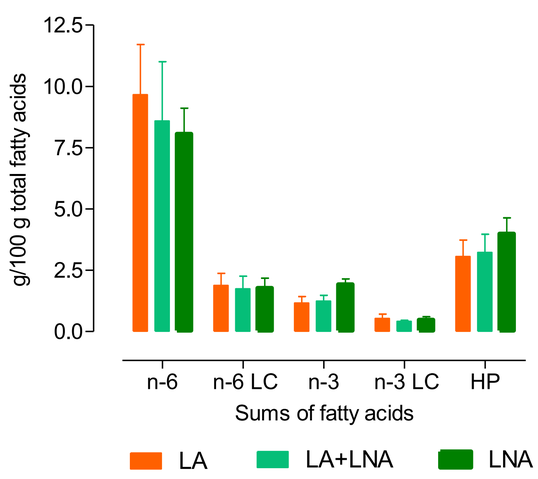
Conclusions

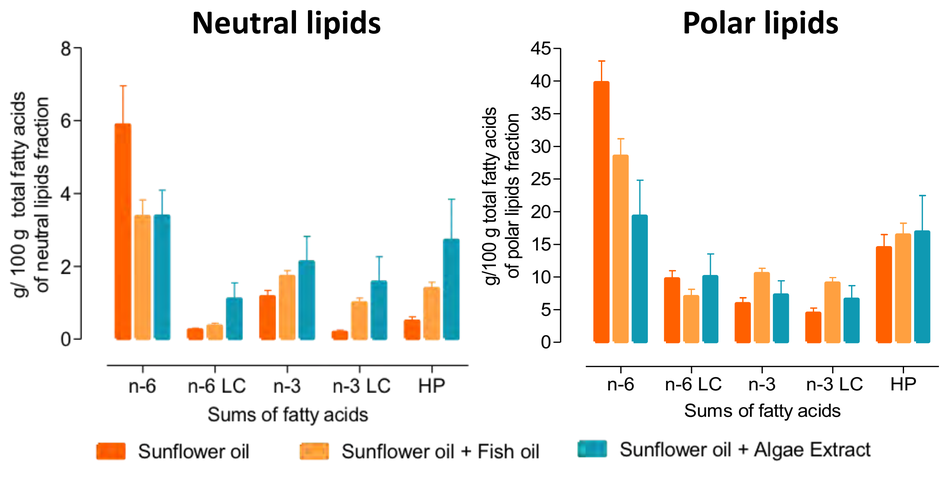
- ✓ Dietary supplementation with lipid sources rich in n-3 PUFA increase the lipid oxidation in meat
- ✓ α-tocopherol level was not enough to prevent the lipid oxidation in meats enriched in n-3 PUFA
- ✓ Higher levels of α-tocopherol or combination with other antioxidants should be considered in n-3 PUFA enriched diets

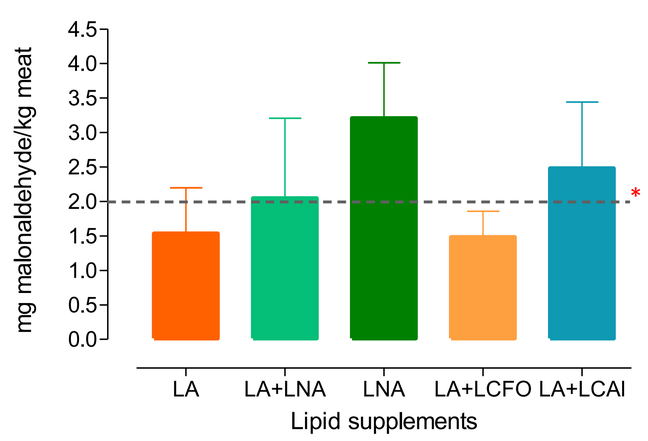

Results

Fatty acid composition of intramuscular fat





Lipid oxidation



* threshold value of 2 mg MDA/kg for consumer acceptability of beef

Lipid supplements rich in linoleic acid (18:2n-6, LA)
- ↑ total n-6 PUFA

Lipid supplements rich in linolenic acid (18:3n-3, LNA)
- ↑ total n-3 PUFA
- ↑ highly peroxidable (HP) PUFA

Fish oil and algae extract
- ↓ total n-6 PUFA
- ↑ total n-3 PUFA, n-3 LC-PUFA and HP-PUFA

Algae extract
- ↑ total n-6 LC-PUFA in neutral lipids
- Highest levels of total n-3 PUFA, n-3 LC-PUFA and HP-PUFA in neutral lipids

Lipid supplements rich in linolenic acid (18:3n-3, LNA)
- ↑ lipid oxidation

Lipid supplements rich in n-3 LC-PUFA from Algae Extract
- ↑ lipid oxidation

n-6 – n-6 polyunsaturated fatty acids; **n-6 LC** – n-6 long chain polyunsaturated fatty acids; **n-3** – n-3 polyunsaturated fatty acids; **n-3 LC** – n-3 long chain polyunsaturated fatty acids; **HP** – Highly peroxidizable polyunsaturated fatty acids, sum of polyunsaturated fatty acids with 3 or more unsaturated bonds

Material and Methods

Animals

- 6 productive trials
- 145 Merino Branco ram lambs
- 6 weeks of trial

Diets

- Forage:concentrate (60:40 – 20:80)
- α-tocopherol (22.5 mg/Kg)

Supplemented with:

→ 6% Soybean oil → 6% Sunflower oil → 3.20% Sunflower + 1.81% peanut + 0.18% olive oils	**LA**
→ 4.20% Sunflower + 1.80% Linseed oils	**LA+LNA**
→ 5.04% Linseed + 0.72% Olive + 0.24% Sunflower oils	**LNA**
→ 4% Sunflower oil + 2% fish oil	**LA+LCFO**
→ 4% Sunflower oil + 3.53% Algae extract	**LA+LCAl**

Diets fatty acid composition

Lipid supplements	Linoleic acid (18:3n-6, LA)	Linolenic acid (18:3n-3, LNA)	n-6 Long Chain (n-6 LC)	n-3 Long Chain (n-3 LC)
	g/100g of total fatty acids			
LA	39.6-51.7	3.60-8.00	-	-
LA+LNA	50.1	13.8	-	-
LNA	29.2	32.2	-	-
LA+LCFO	16.1	2.11	0.33	1.47
LA+LCAl	40.6	7.56	3.46	7.67

Sampling

- ***Longissimus thoracis muscle*** (72 h after slaughter)

Vacuum packed, stored at –80°C → Fatty acid quantification in intramuscular fat (Folch *et al.* 1957, *J Biol Chem*, 226:497-509; Oliveira *et al.* 2016, *Anim. Feed Sci. Techn.*, 213: 64-73)

Individually placed on polystyrene trays, over-wrapped with O_2 permeable film, stored at 2°C for 7 days → Lipid oxidation determination (*Grau et al. 2000, J. Agric Food Chem, 48:1155-1159*)

Aknowledgements:
This work was supported by the Program Alentejo 2020, through the FEDER under the scope of "ValRuMeat" (ALT20-03-0145-FEDER-000040). The authors would like to thank FCT/MCTES through the PTDC/CVT/ 103934/2008, UID/AGR/00115/2019 and UID/CVT/00276/2019 projects.