



UNIMORE

UNIVERSITÀ DEGLI STUDI DI
MODENA E REGGIO EMILIA

Research Doctorate in AGRI-FOOD SCIENCES,
TECHNOLOGIES AND BIO-TECHNOLOGIES

XXXII Cycle

**Improvement of nutritional and technological
characteristics of pork by supplementing the diet with
extruded linseed and synthetic or natural antioxidants**

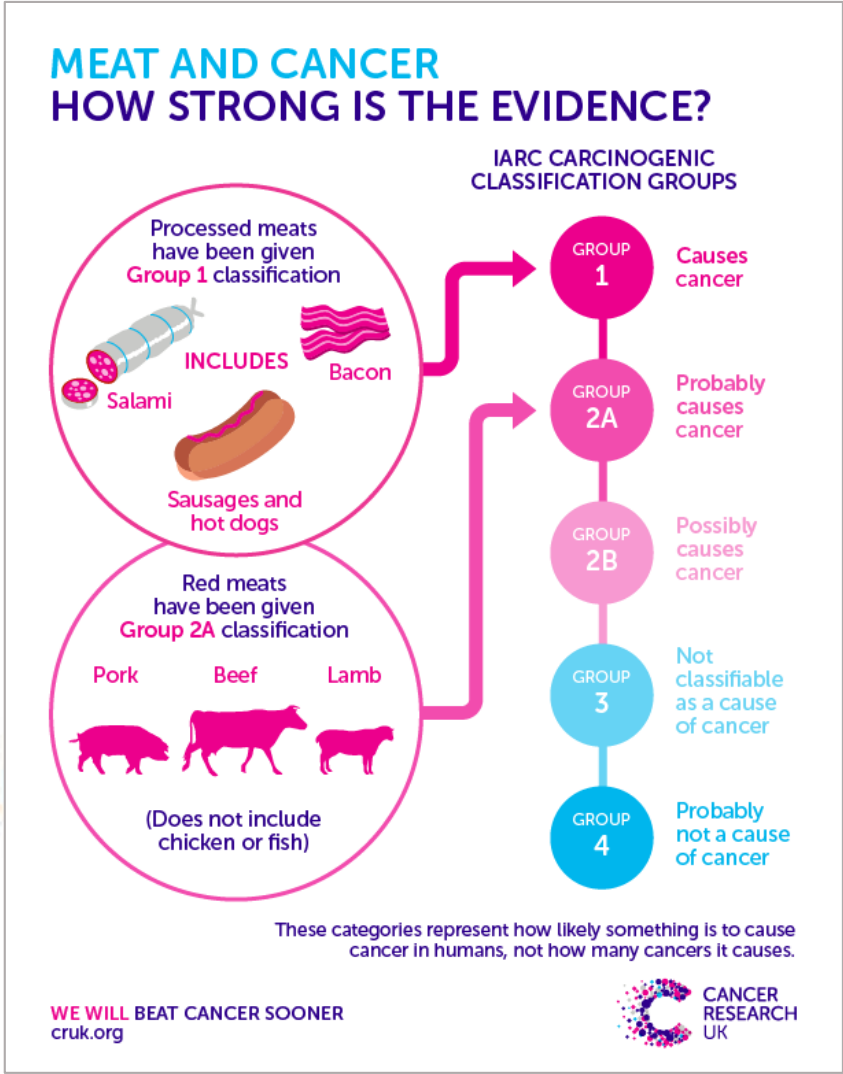
n-3 and antioxidants in pig diets

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The 26th of October 2015





IARC stated “each 50g portion of processed meat eaten daily increases the risk of colorectal cancer by 18%”.

The WCRF recommends that people **eat** no more **than** 500g of **red meat** a **week** (around 70g a day) and avoid processed **meat**.

The Guardian

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Wurst case scenario: Germany and Austria defend their sausages

Austrian food minister calls WHO report on cancer risk of processed meats a ‘farce’, as he and his German counterpart rally behind bratwursts and cold cuts



Germany's chancellor, Angela Merkel, holds aloft a Thüringer Rostbratwurst a few years ago. Photograph: Wolfgang Rattay/Reuters

The Guardian

Italy's Parma ham connoisseurs defend prosciutto amid processed meat scare

Parma Ham Consortium insists Italian staple is a healthy unprocessed meat and warns against ‘meaningless alarmism’



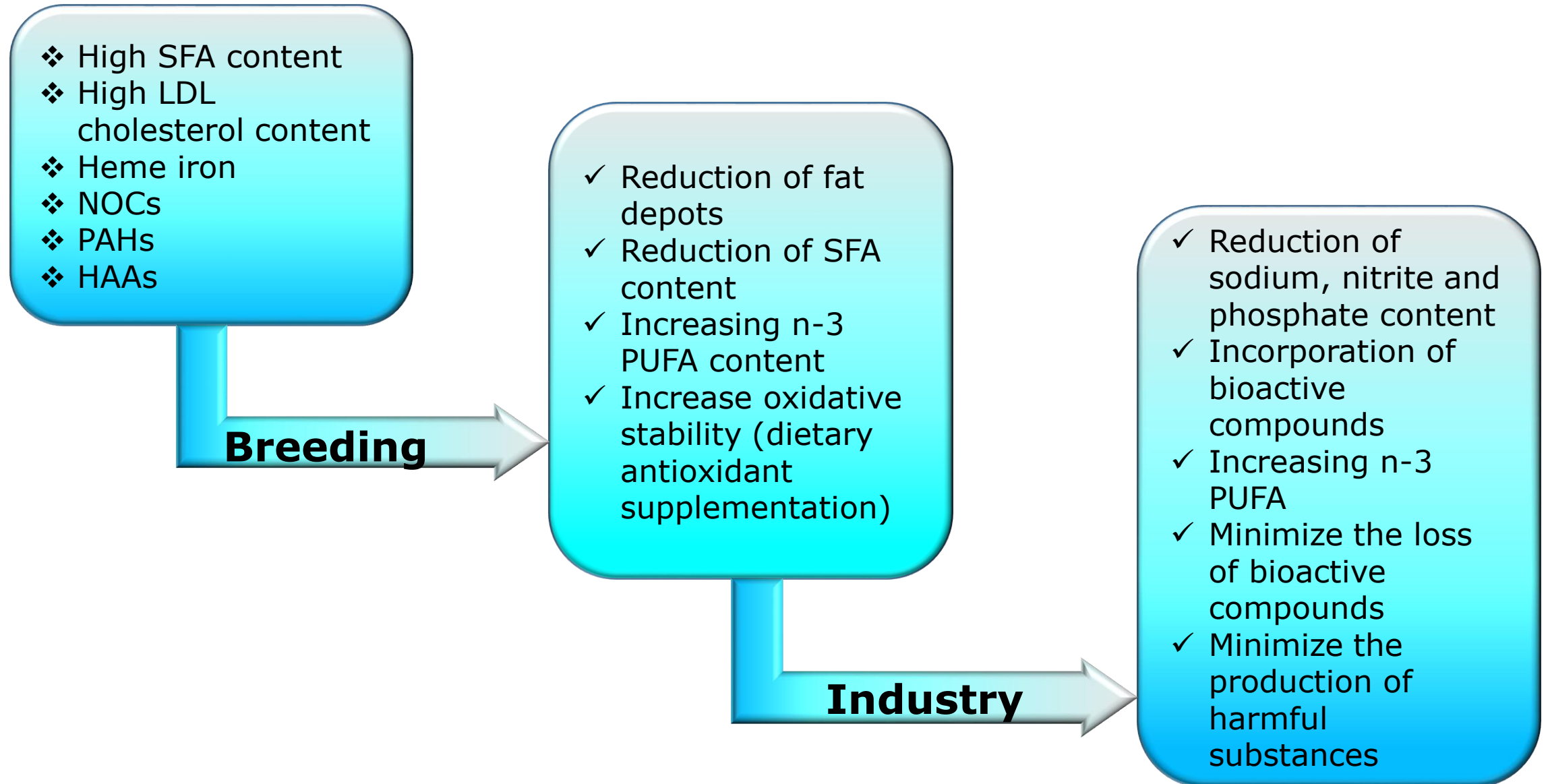
This is not just any ham, it's prosciutto di Parma, the Italian consortium says. Photograph: Guardian

Meat processors respond to I.A.R.C. report

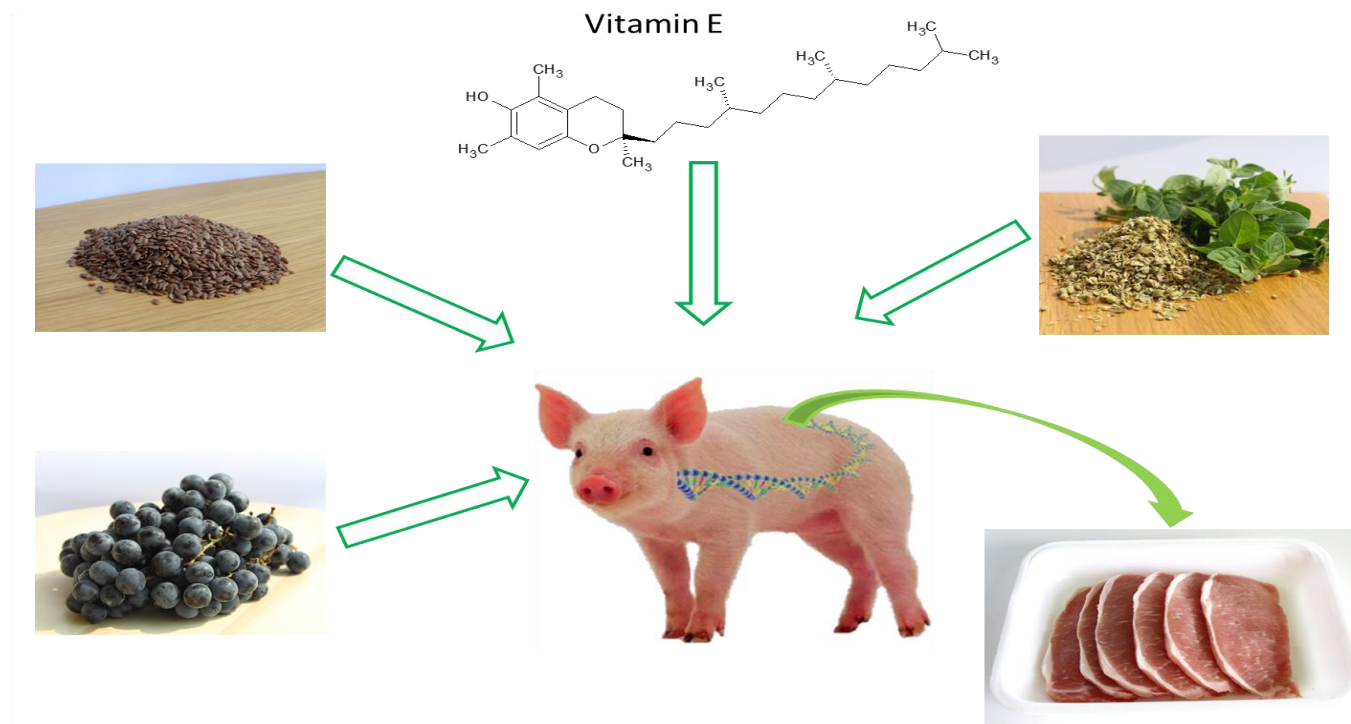
10.28.2015 By Lawrence Aylward



The I.A.R.C. recently reported that bacon and processed meats are "carcinogenic to humans based on sufficient evidence," while consumption of red meat was classified as "probably carcinogenic" to humans.



Production of “healthier” pork by feeding pigs with ingredients rich in n-3 fatty acids as extruded linseed and addition of synthetic or natural antioxidants for improving meat quality.





4 pigs/diet

C

Control diet

- A barley/soybean based diet

LE

Linseed and synthetic antioxidants diet

- 5% extruded linseed
- 200 mg/kg feed Vitamin E
- 0.21 mg/kg feed Selenium

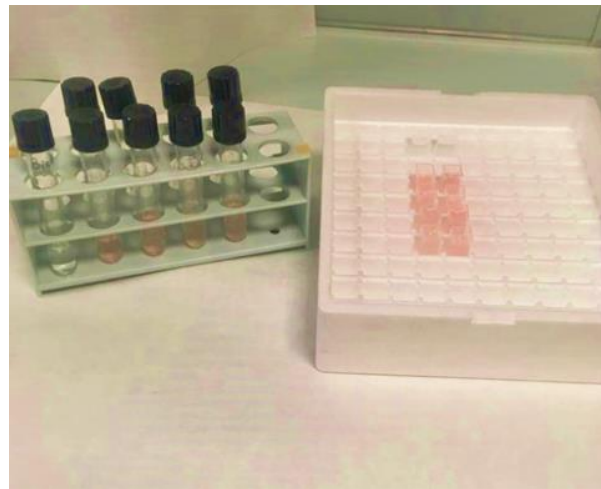
LGSE

Linseed and grape skin extract diet

- 5% extruded linseed
- 3 g/kg feed grape skin extract

Fresh meat

- ❖ pH
- ❖ Colour (CIE L*a*b* 1976)
- ❖ TBARS of raw and cooked meat (Siu & Draper 1978)
- ❖ Drip loss
- ❖ Cooking loss
- ❖ Shear force (Honikel 1998)

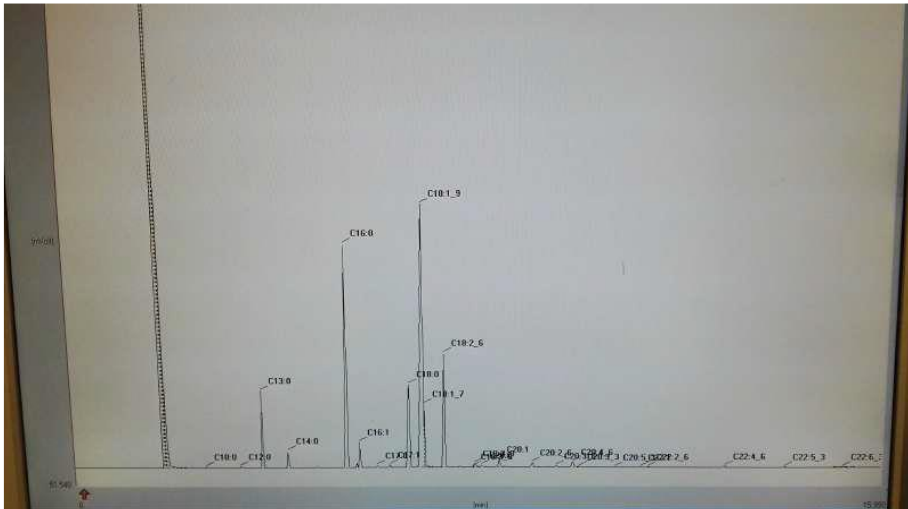
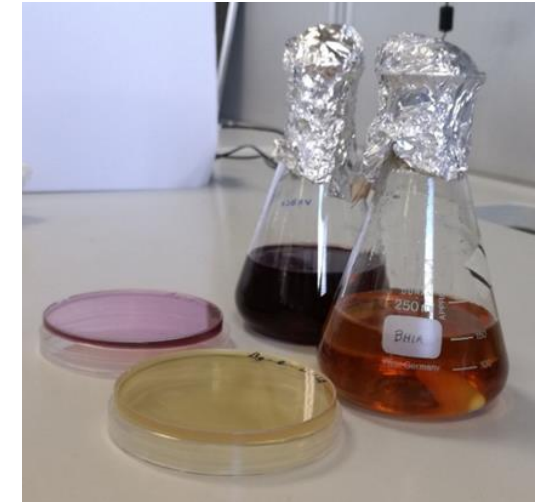
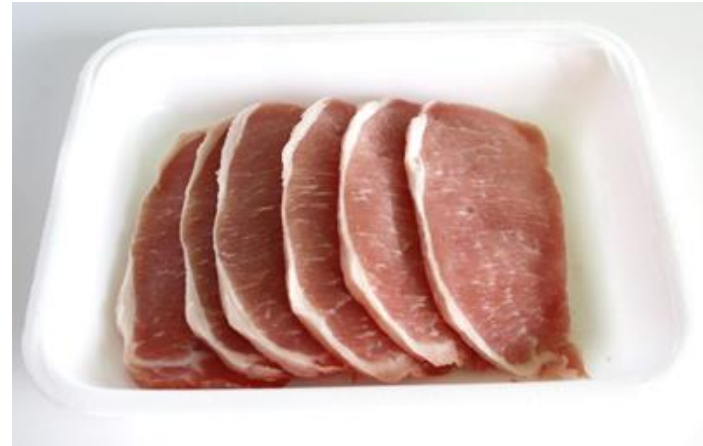


Chemical composition of meat

- ❖ Crude protein
- ❖ Crude fat
- ❖ Moisture (AOAC 1995)

Shelf-life study

- ❖ pH
- ❖ Colour
- ❖ TBARS
- ❖ Weight loss
- ❖ Microbial growth



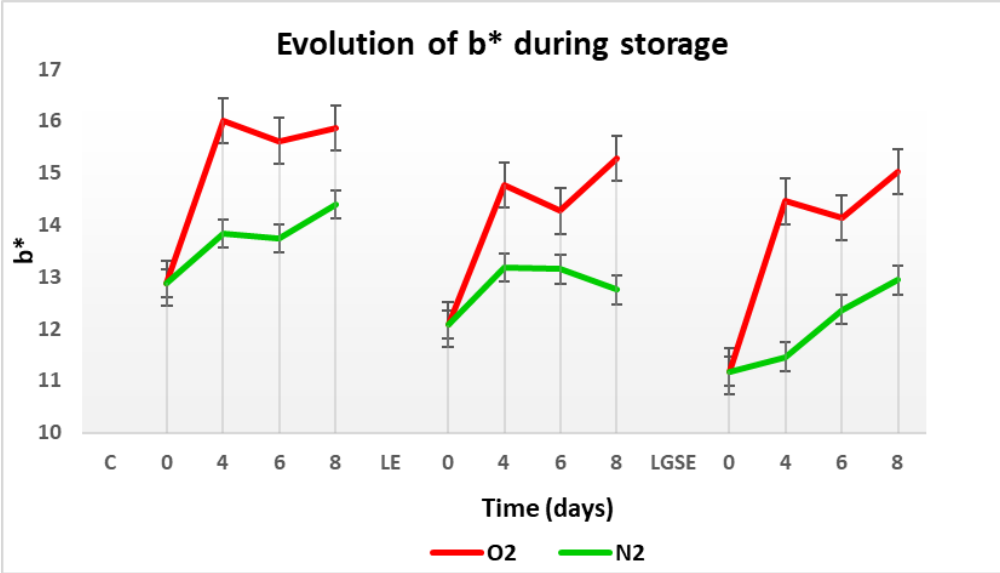
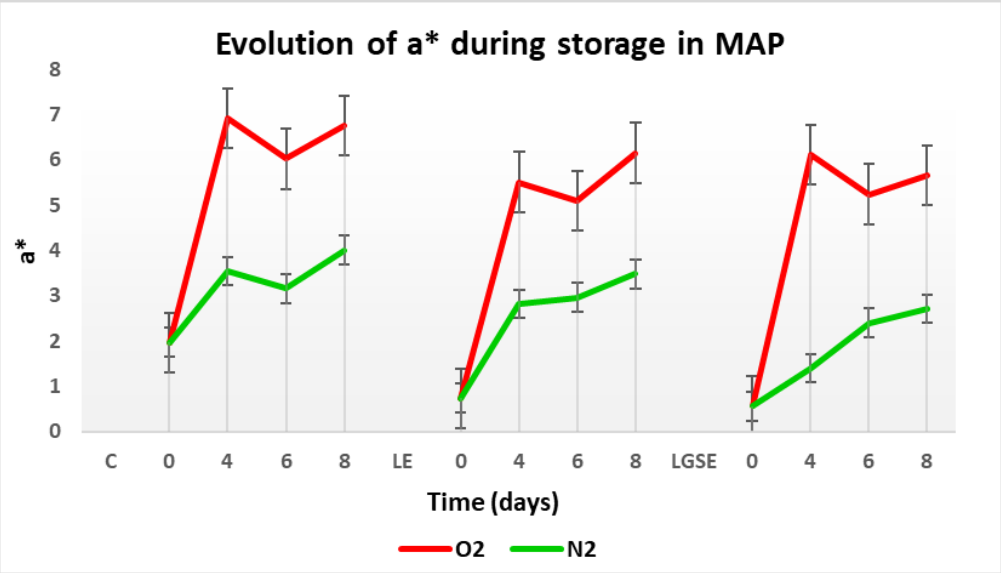
Total lipid and fatty acid composition

Folch et al. (1957) extraction method

Fatty acids were identified and quantified by GC.

Statistical analysis

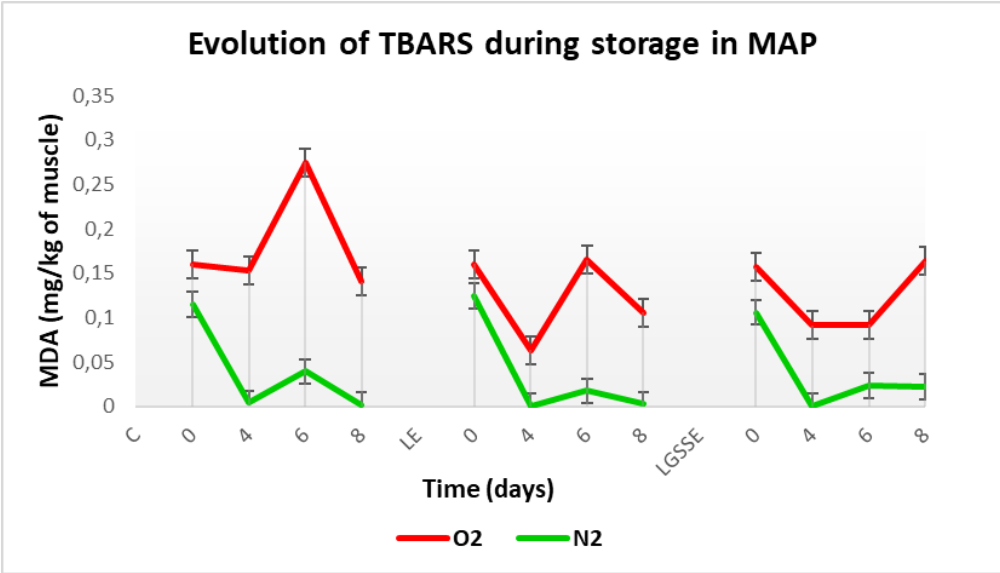
The data were analyzed using SAS procedure (SAS Institute Inc., Cary, NC, USA).

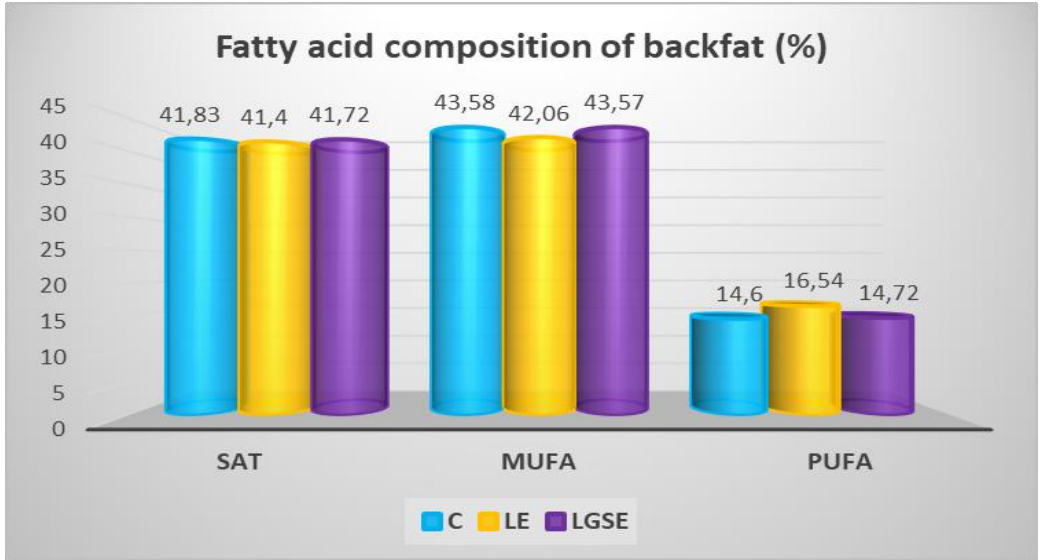
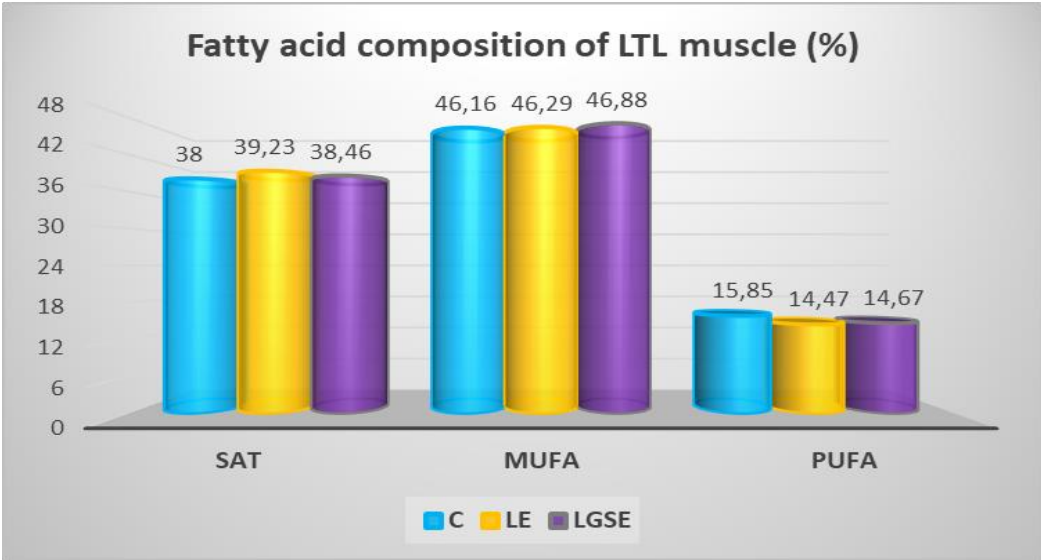


O₂ MAP 70/30 O₂/CO₂

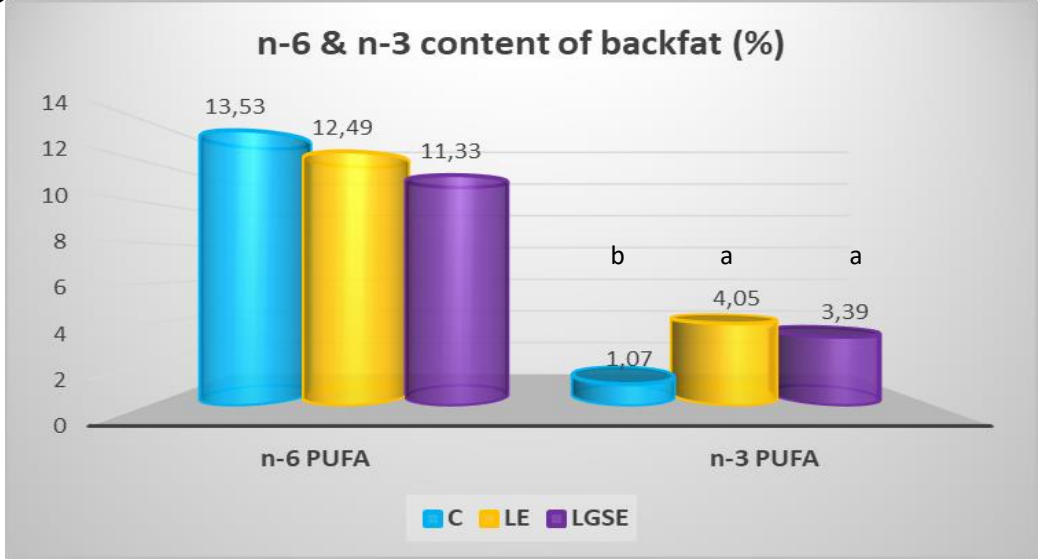
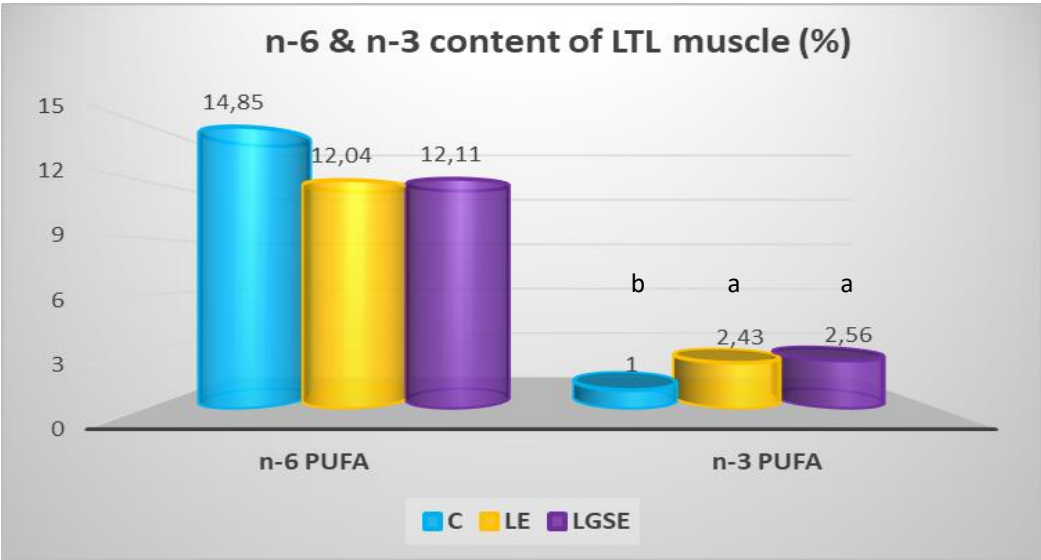
N₂ MAP 70/30 N₂/CO₂

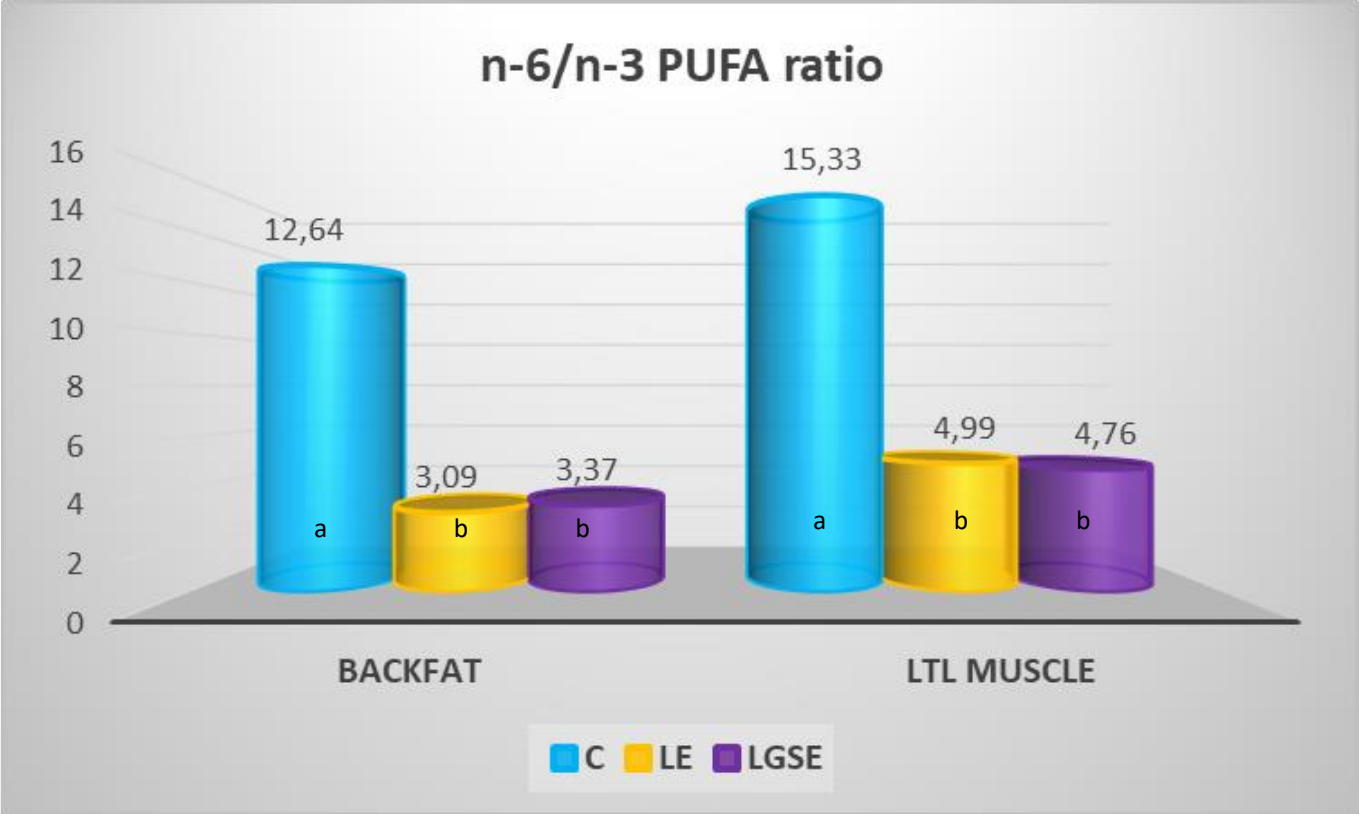
P < 0.05





$P < 0.05$





$P < 0.05$

n-6/n-3 PUFA ratio	
OPTIMAL	4:1
WESTERN DIET	10-25:1
ITALIAN DIET	~ 13-1

C 18:3n-3	(ALA)	
C 20:3n-3		
C 20:5n-3	(EPA)*	
C 22:5n-3	(DPA)*	

*EPA only in LTL muscle

*DPA only in backfat

- ❖ Dietary treatments did not affect qualitative characteristics and chemical composition of muscle, except for the fatty acid composition.
- ❖ O₂ MAP brought an increase in oxidative products and yielded redder meat, irrespective of the dietary treatment.
- ❖ Supplementation with supra-nutritional levels of Vitamin E and Selenium did not impair the oxidative stability compared to a standard diet during refrigerated storage.
- ❖ 5% of dietary extruded linseed included in the pig finishing diet is a suitable means to increase n-3 PUFA content and to reduce the n-6/n-3 PUFA ratio in pig tissues.



12 pigs/diet

C

Control diet

- A barley/soyabean based diet

L

Linseed diet

- 5% extruded linseed

LE

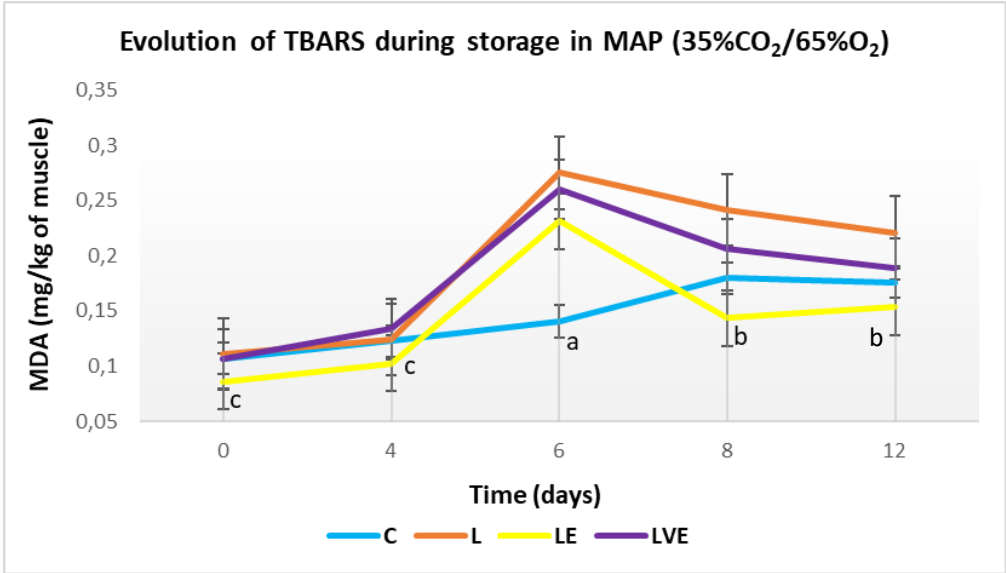
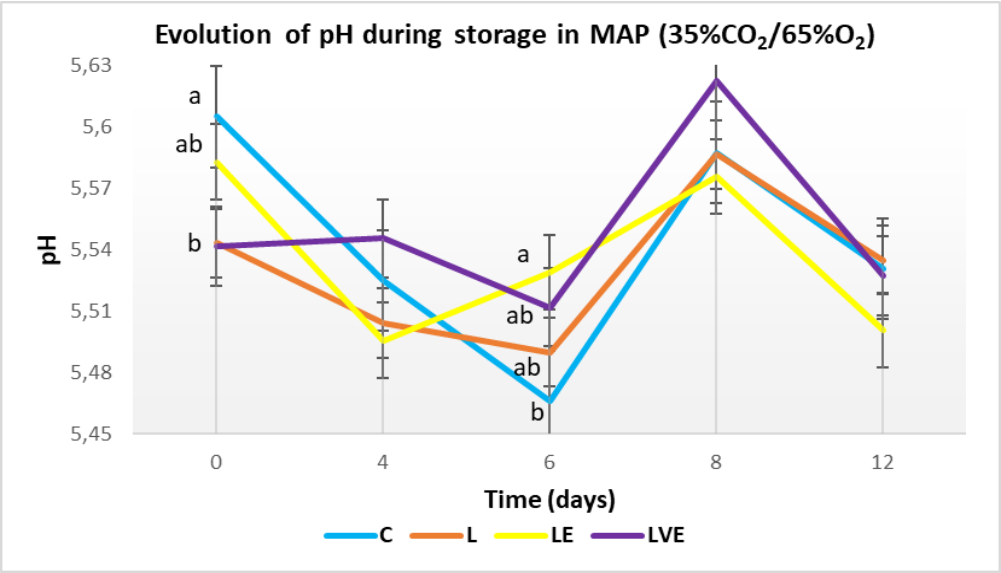
Linseed and synthetic antioxidants diet

- 5% extruded linseed
- 200 mg/kg feed Vitamin E
- 0.21 mg/kg feed Selenium

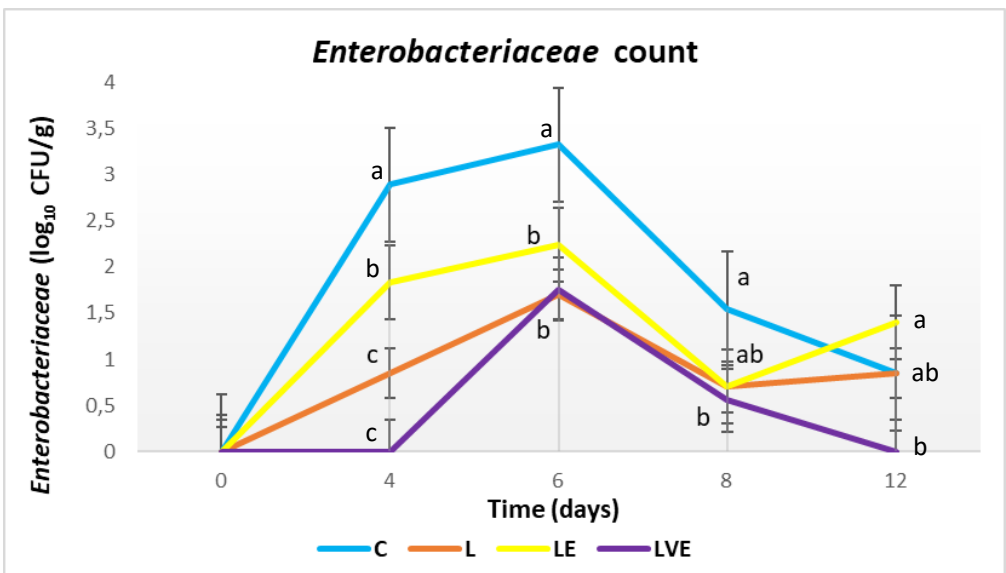
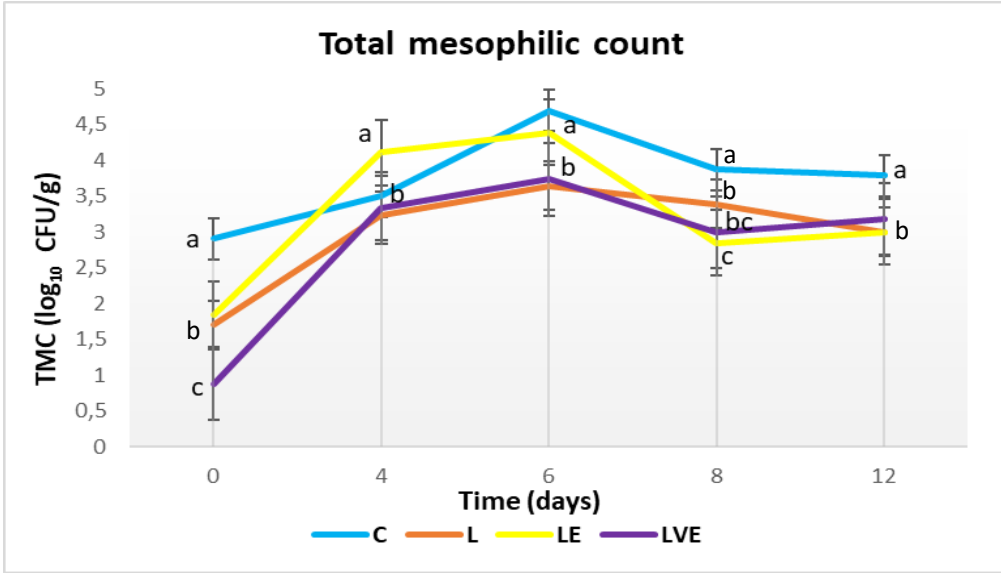
LVE

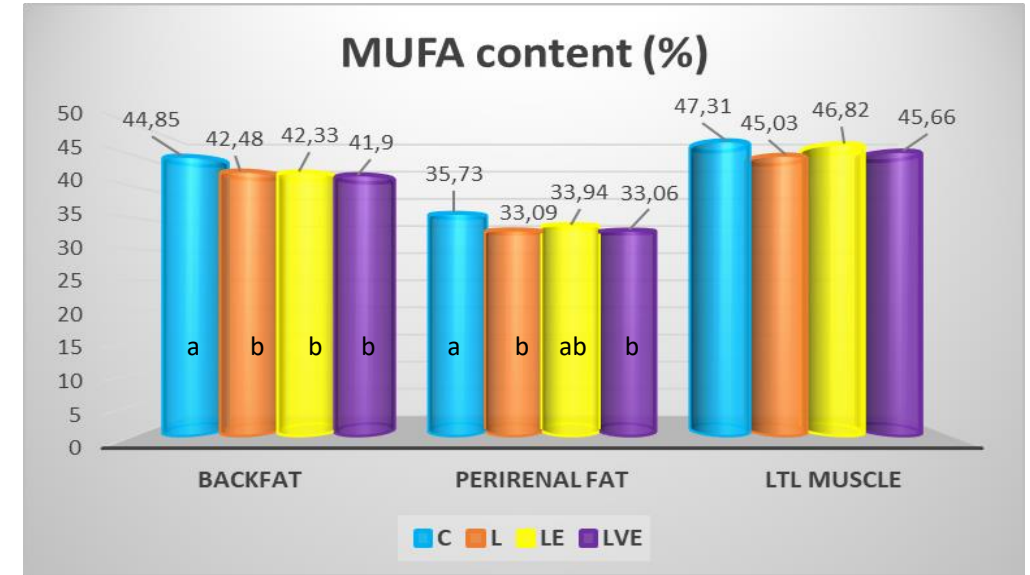
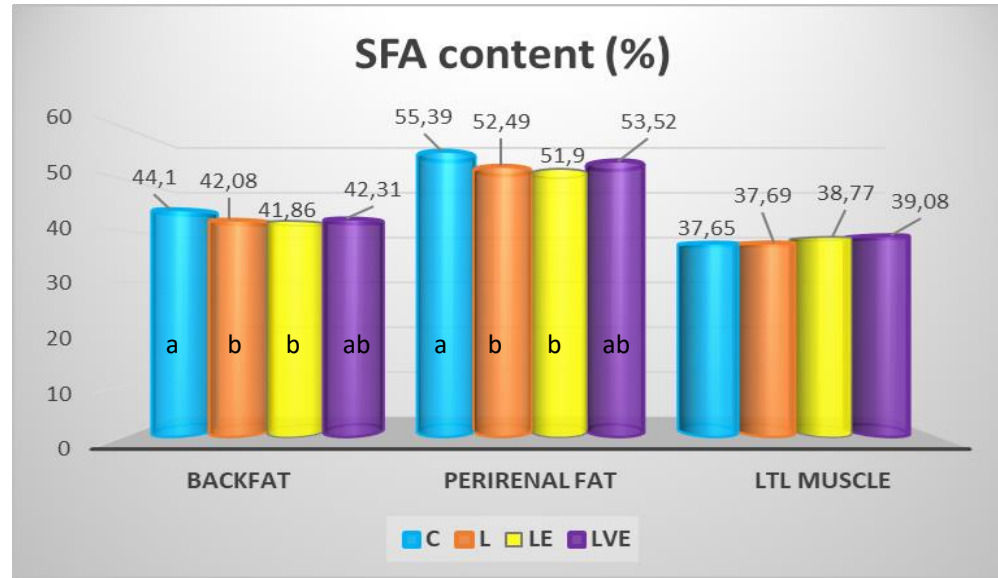
Linseed and vegetal extracts diet

- 5% extruded linseed
- 3 g/kg feed grape skin extract
- 2 g/kg feed oregano extract

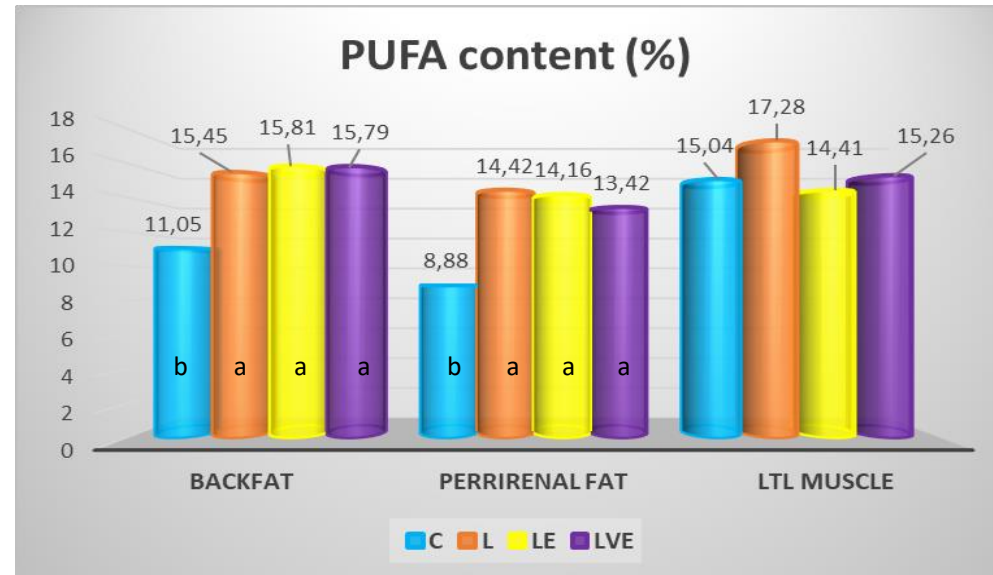


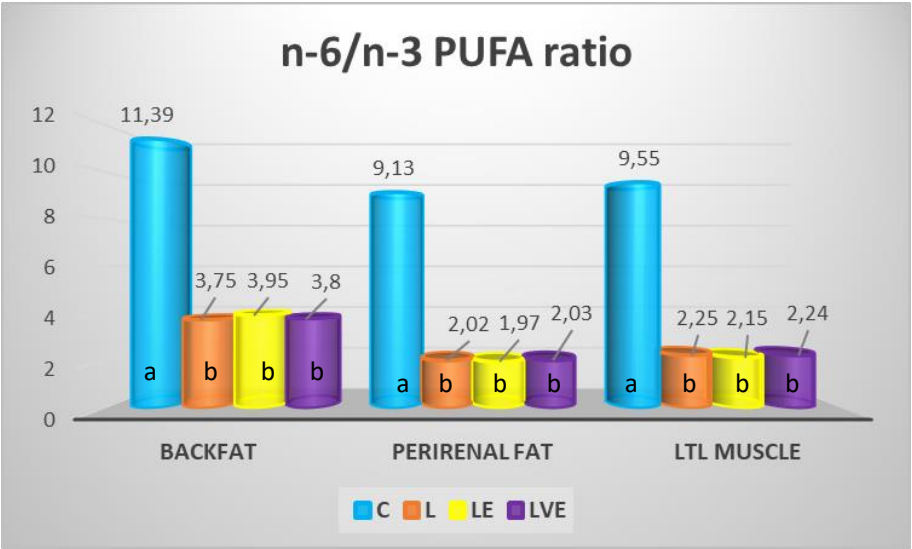
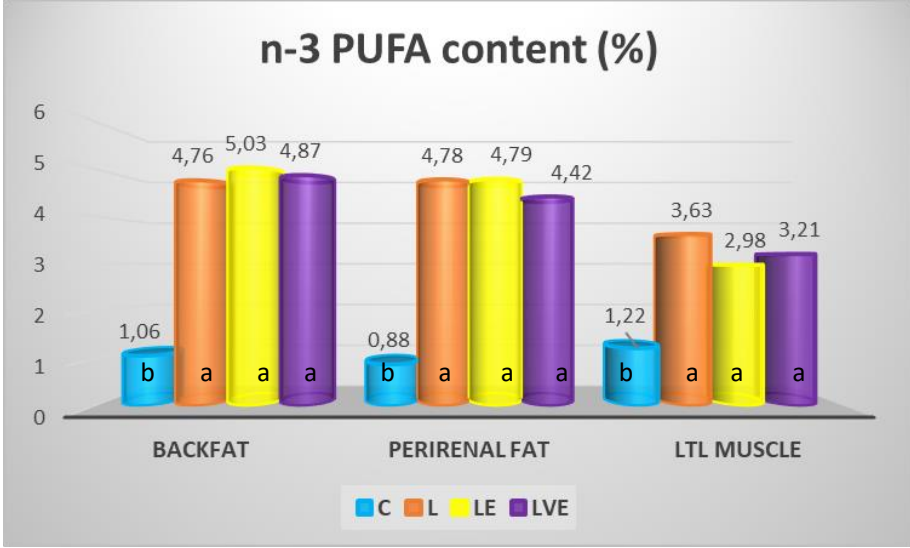
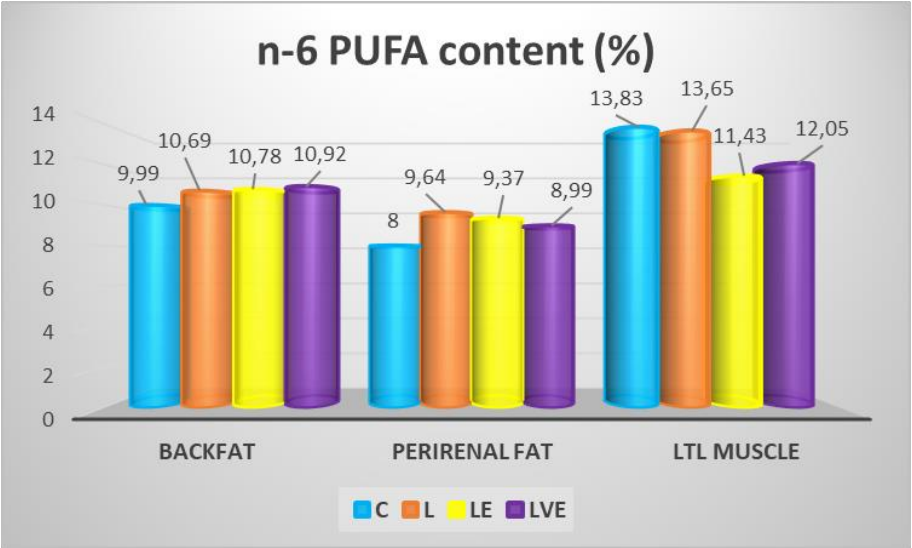
$P < 0.05$





$P < 0.05$





n-6/n-3 PUFA ratio	
OPTIMAL	4:1
WESTERN DIET	10-25:1
ITALIAN DIET	~ 13-1

P < 0.05

C 18:3n-3 (ALA)	↑
C 20:3n-3	
C 20:5n-3 (EPA)	
C 22:5n-3 (DPA)	↓
C 18:3n-6*	
C 20:4n-6	
C 22:4n-6	

* Not in perirenal fat

- ❖ Addition of extruded linseed and antioxidants in pig diets did not affect quality parameters and chemical composition of muscle.
- ❖ Dietary treatments did not reduce the pork quality during refrigerated storage, while it improved the microbial status of meat, in particular the *Enterobacteriaceae*.
- ❖ 5% of extruded linseed in pig diets significantly increased the n-3 PUFA content in LTL muscle, backfat and perirenal fat.
- ❖ 5% of extruded linseed in pig diets significantly reduced n-6/n-3 PUFA ratio.

- Dietary treatments did not affect qualitative characteristics and chemical composition of muscle.
- Dietary treatments did not reduce the pork quality during refrigerated storage.
- 5% of extruded linseed inclusion in pig diets improved the fatty acid profiles of all tissues, increasing considerably the n-3 PUFA and reducing the n-6/n-3 PUFA ratio to levels optimal for human health.
- Further experimental investigations are needed to explain the lack of antioxidant activity of vegetal extracts and to find the optimal supplementation dose.

Thank You

**We keep our
eyes peeled
on the meat,
so you can eat
it with eyes
closed.
(Assocarni)**

