

LMC Annual Professional Development Event  
for Teachers of Home Economics  
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# Omega-3 Research

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# Overview

- Introduction to research project
- Omega- 3 fatty acids
- Aims of research
- Studies 1- 3
- Summary of findings
- Implications

# Introduction to research project

- DEL CAST studentship
- Industry part-funded through AgriSearch (organised by LMC)
- 3 year duration from Oct 2006- Oct 2009 at UU
- In collaboration with the Agri-Food and Biosciences Institute (AFBI)

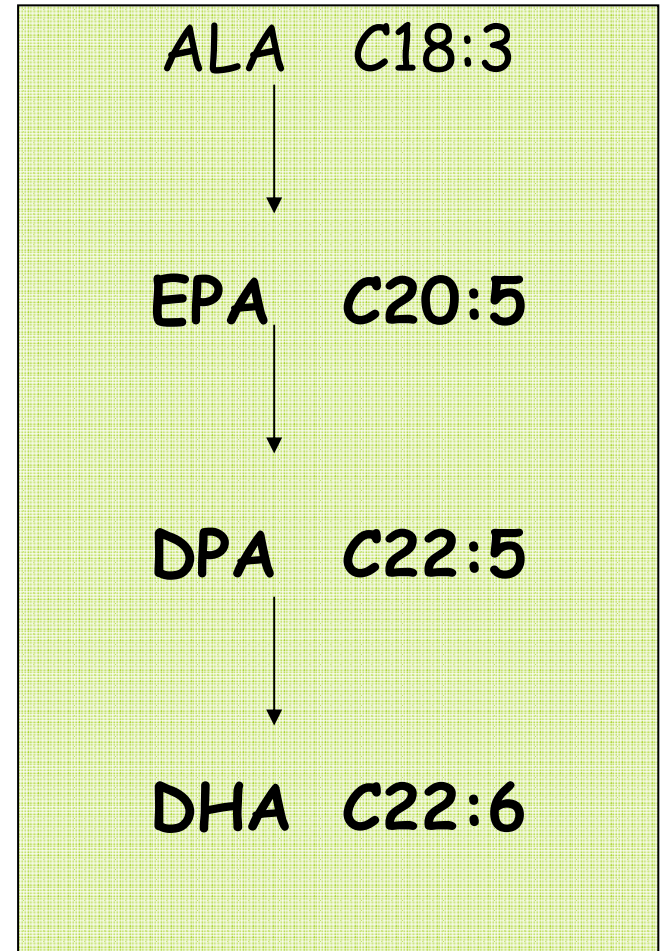


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# Omega-3 fatty acids

- Alpha- linolenic acid (ALA) is the parent molecule of the omega-3 (n-3) polyunsaturated fatty acid (PUFA) family and is a dietary essential
- From ALA, the longer chain n-3 PUFA can be synthesised (LCn-3 PUFA); EPA, DPA and DHA
- These LCn-3 PUFA have the most beneficial effects on human health



# Benefits of LCn-3 PUFA

## **Anti- inflammatory action**

May improve symptoms of conditions with an inflammatory component (rheumatoid arthritis, autoimmune conditions)

## **Cognitive health**

Essential for foetal brain development, adult brain function  
May help slow cognitive decline associated with ageing

## **Cardiovascular health**

Beneficial effects to heart health and circulation. May prevent cardiovascular disease (CVD) and risk of secondary event in CVD patients

# Dietary recommendations

- We are recommended to consume at least **450 mg** per day of EPA & DHA for optimum health <sup>1</sup>
- ALA is found in many foods (green leafy vegetables, vegetable oils, nuts and seeds)
- However the conversion of ALA to LCn-3 PUFA in the body is inefficient
- In order to obtain adequate LCn-3 PUFA in our diet, we should consume dietary sources of LCn-3 PUFA rather than ALA

<sup>1</sup> Scientific Advisory Committee on Nutrition (SACN/ COT),  
2005

# Food sources of LCn-3 PUFA



Oily fish is the richest source of EPA & DHA

1- 3g/ 100g serving<sup>1</sup>

Beef and lamb are sources of EPA, DPA & DHA

20- 50 mg/100g serving<sup>2</sup>



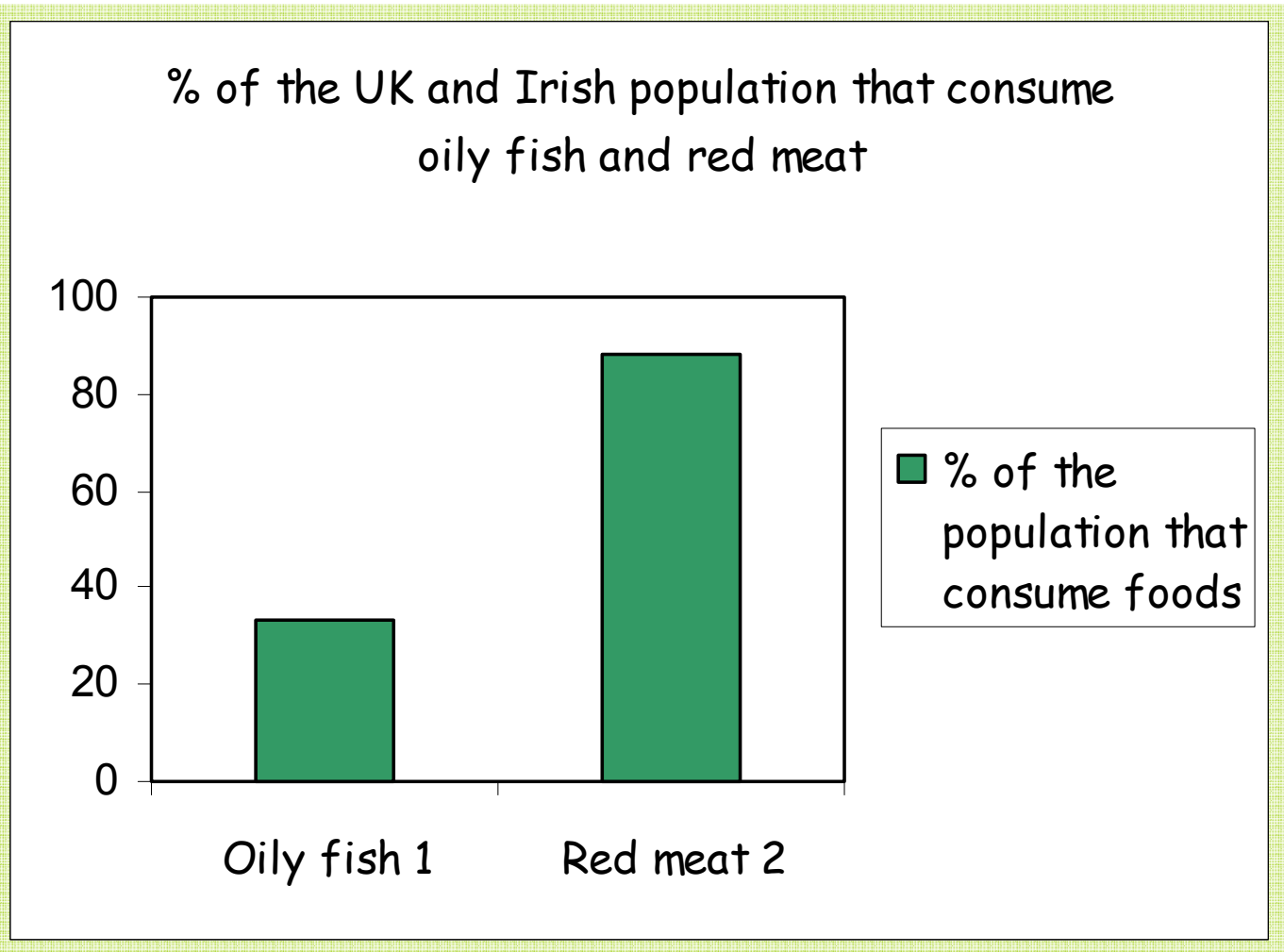
<sup>1</sup> Philibert *et al* (2006) AJCN 84, 1299- 307

<sup>2</sup> Enger *et al* (1996) Meat Science 43 (4) 443- 456

**Yet...**



**Among the UK population  
LCn-3 PUFA intakes remain  
inadequate (approx 100-  
200mg/d) <sup>1</sup>**



<sup>1</sup> Henderson & Gregory (2002), The Stationery Office

<sup>2</sup> Cosgrove *et al* (2005), *BJN* 93 (933-942)

# Red meat from grass-fed animals



Beef and lamb produced from grass-fed animals contain **greater** concentrations of LCn-3 PUFA than that produced from cereal-fed animals

Research in Australia has shown that red meat contributes significantly to total dietary intakes of LCn-3 PUFA, due to red meat consumption being up to 6 times greater than that of oily fish <sup>1</sup>

.....It is possible that red meat provides greater amounts of LCn-3 PUFA to the Irish diet than previously recognised!

# Aims of project

- To fill in knowledge gaps on quantities of LCn-3 PUFA found in beef and lamb produced in Northern Ireland from animals fed different diets
- To allow an estimation of total dietary intakes of LCn-3 PUFA in the Irish population to be made
  - including the contribution of red meat from animals fed grass and cereals

# 3 Studies:

- Study 1- Fatty acid content of locally produced beef and lamb and feeding diets used by producers
- Study 2- Dietary intervention study investigating red meat consumption and LCn-3 PUFA status in humans
- Study 3- Potential of red meat to contribute to total dietary intakes of LCn-3 PUFA

# Study 1

# Aims of Study 1

- To provide fatty acid compositional data for beef and lamb produced in Northern Ireland
  - including effects of season and animal finishing diet on LCn-3 PUFA
- To identify use of animal finishing diets by red meat producers in Northern Ireland

# Sample collection

- Approx 200 samples of beef and lamb collected from animals slaughtered over May 2007-April 2008 from Dunbia abattoir
- Samples analysed for fatty acid content



# Postal survey

- Postal survey carried out among a sample of red meat producers in Northern Ireland
- Used to identify the seasonal use of different finishing diets prior to slaughter



# Results of Study 1

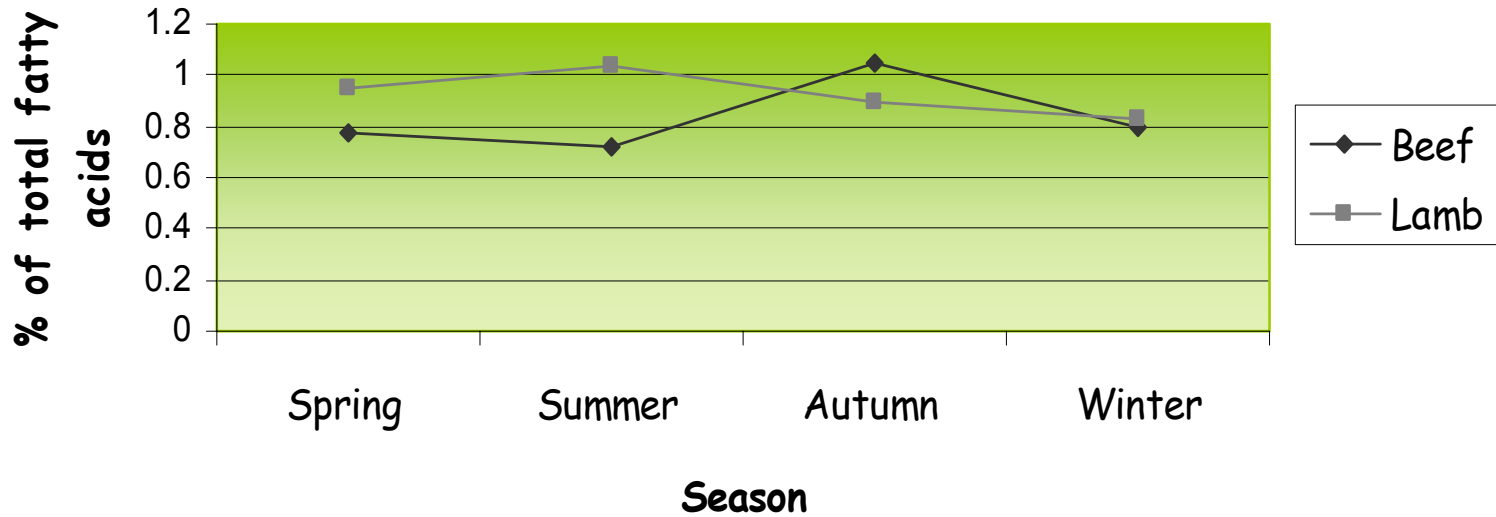
Mean LCn-3 PUFA content mg/100g muscle		
	Beef ( <i>n</i> = 236)	Lamb ( <i>n</i> = 217)
C20:5 n-3 (EPA)	8.53	14.36
C22:5 n-3 (DPA)	11.86	15.53
C22:6 n-3 (DHA)	0.86	3.79
LCn-3 PUFA	21.22	33.68

Beef and lamb were found to contain an average of 21 and 34 mg/100g muscle

# Results of Study 1...

- Majority of producers surveyed reported exclusive grass-feeding of animals over the summer months
- LCn-3 PUFA concentrations varied over the year due to variation in season and animal diet
- Beef finished in autumn and lamb finished in summer contained highest concentrations of LCn-3 PUFA

## Variation in concentrations of LCn-3 PUFA within beef and lamb produced in different seasons



# Study 2

# Aims of Study 2

- To investigate the effect of regular consumption of red meat on LCn-3 PUFA status in healthy adults
- To compare effects on plasma and platelet LCn-3 PUFA status of consuming red meat produced from either grass-fed or cereal-fed animals

# Meat collection

- Beef and lamb for human consumption were sourced from animals fed grass or cereals for 6 wks prior to slaughter
- Steak, mince beef and lamb chops were prepared into individual portions
- Dietary intervention study carried out among healthy subjects at UU

Healthy subjects randomised into two groups  
Males (n=19) females (n=19)

**Baseline measurements:**  
Dietary intake, blood pressure, plasma & platelet fatty acid composition,  
serum lipids and lipoproteins



Grass-fed

4  
wks



Cereal-fed

**Post- intervention measurements:**  
Dietary intake, blood pressure, plasma & platelet fatty acid composition,  
serum lipids and lipoproteins

# Results of Study 2

- Plasma and platelet concentrations of LCn-3 PUFA were significantly higher in the group that consumed red meat from grass-fed animals
- No significant differences were found between groups in levels of cholesterol, triacylglycerols or blood pressure

# Study 3

# Aim of Study 3

- To estimate the contribution of red meat, from grass-fed and cereal-fed animals, to total dietary intakes of LCn-3 PUFA in the Irish population



# Outline of Study 3

- The contribution of red meat to total LCn-3 PUFA intakes was assessed using:
  - Current food intake data from the North South Ireland Food Consumption Survey (NSIFCS)<sup>1</sup>
  - Fatty acid data for red meat from Study 2, and for all other foods from food composition tables<sup>2</sup>

<sup>1</sup> Irish Universities Nutrition Alliance (2001) NSIFCS. [www.iuna.net](http://www.iuna.net)

<sup>2</sup> MAFF (1998) McCance & Widdowson's The Composition of Foods Fatty Acid Supplement

# Results of Study 3

- Total LCn-3 PUFA intake in the Irish diet was estimated at:
  - 309 mg/d when red meat from grass-fed animals was consumed
  - 300 mg/d when red meat from cereal-fed animals was consumed
- However, this presumes that oily fish is being regularly consumed

# Results of Study 3...

- In the hypothetical absence of fish from the diet..
- Beef and lamb produced from **grass-fed** animals would potentially supply 41% of total daily LCn-3 PUFA intake compared with 29% from cereal-fed animals
- Although total intakes are much lower (51 mg/d and 43 mg/d)

# Summary of findings

- Red meat is a source of LCn-3 PUFA in the Irish diet
- The animal finishing diet has an impact on amounts of LCn-3 PUFA absorbed by red meat consumers
- The potential contribution of red meat to total daily LCn-3 PUFA intakes becomes modestly greater were all red meat consumed to be from grass-fed animals

# Summary of findings...

- Considerable grass-based production of red meat occurs in Northern Ireland, particularly in summer months
- However seasonal variation in diet = seasonal variation in LCn-3 PUFA levels in meat

# Implications

- Any effort to enhance the content of LCn-3 PUFA in red meat would be beneficial in helping raise consumer total daily intakes of LCn-3 PUFA
- Further research needed to investigate whether quantities of LCn-3 PUFA consumed from meat may have a positive impact on health

# Questions?

Thank you for listening!