

On-farm influences on the nutritional quality of beef

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Presentation outline

- Nutritional value
- The challenge
- Progress to date
- Summary/conclusions

Nutritional quality of beef



- High biological value protein
- Micronutrients
 - minerals: iron, zinc, selenium
 - vitamins A, B₃, B₆, B₁₂, D, E,
 - carotenoids

But consumers

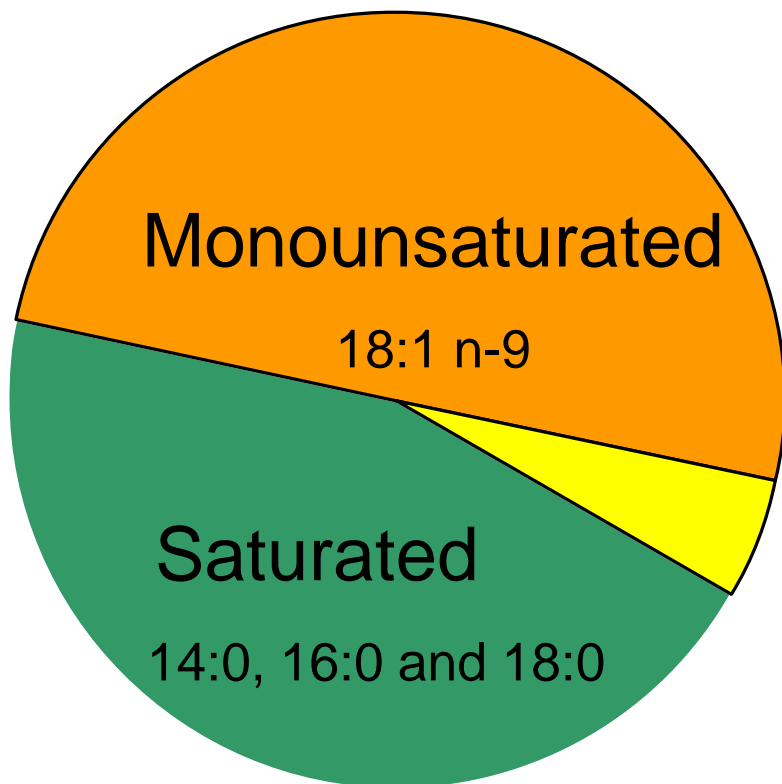


are told that:

- “Beef is high in fat and calories”
- “Beef contains saturated fat which is bad for the heart”



Fatty acids in beef



Polyunsaturated fatty acids

- linoleic acid (18:2 n -6)
- alpha-linolenic acid (18:3 n -3)
- eicosapentaenoic acid (20:5 n -3; EPA)
- docosahexaenoic acid (22:6 n -3; DHA)

Conjugated linoleic acid

may modulate the risk of:

- cancer
- atherosclerosis
- chronic inflammatory diseases
- obesity
- diabetes
- osteoporosis

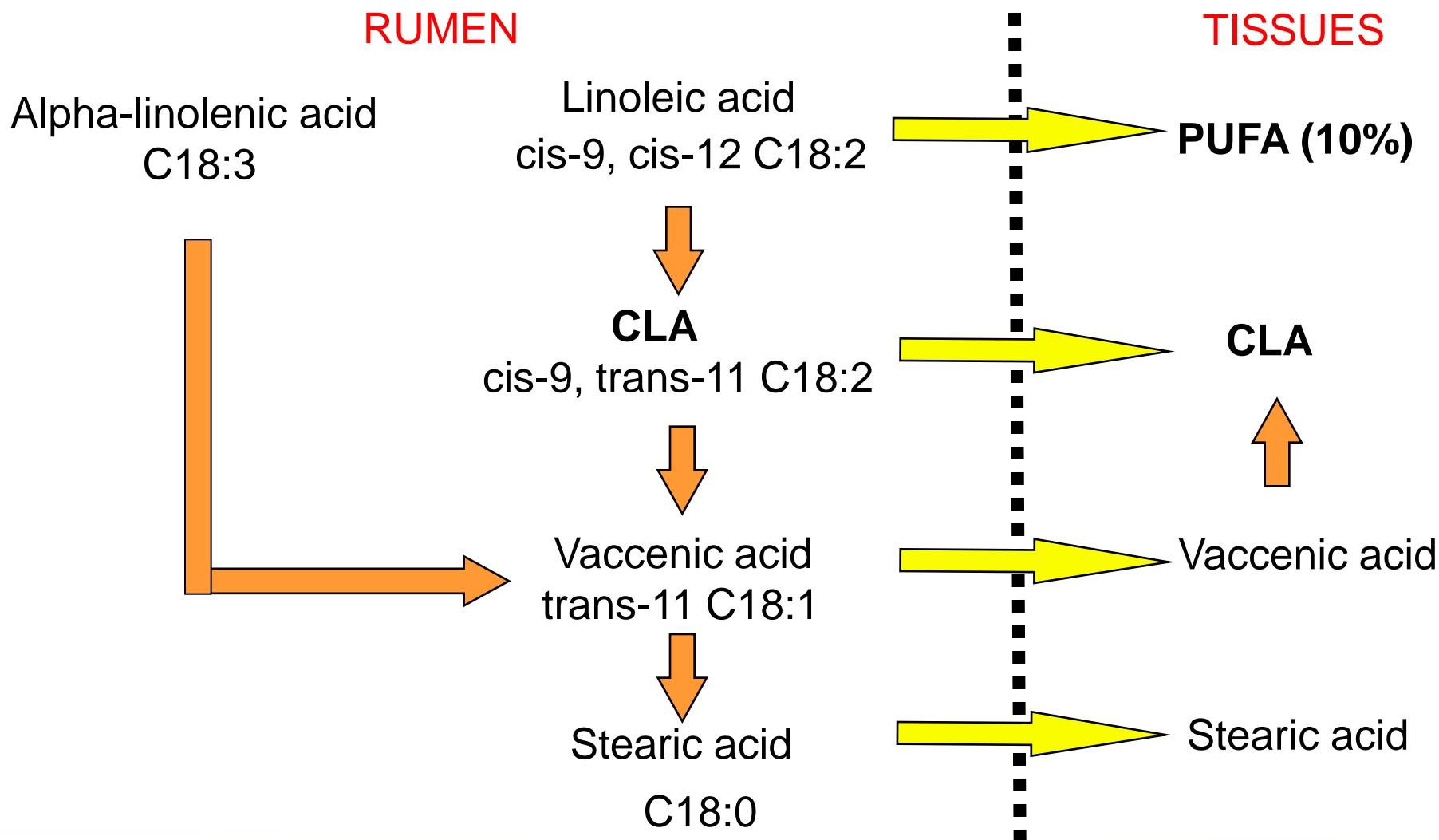
Improved nutritional composition

- Low total fat content ($< 4\%$ = low fat food)
- High polyunsaturated : saturated fatty acid ratio (> 0.4 recommended)
- Low omega-6: **omega-3 polyunsaturated fatty acid** ratio ($< 3:1$ recommended)
- “High” **conjugated linoleic acid**
- “Low” *trans* fatty acids

Challenge = Lipid metabolism in the rumen



Lipid metabolism in the ruminant



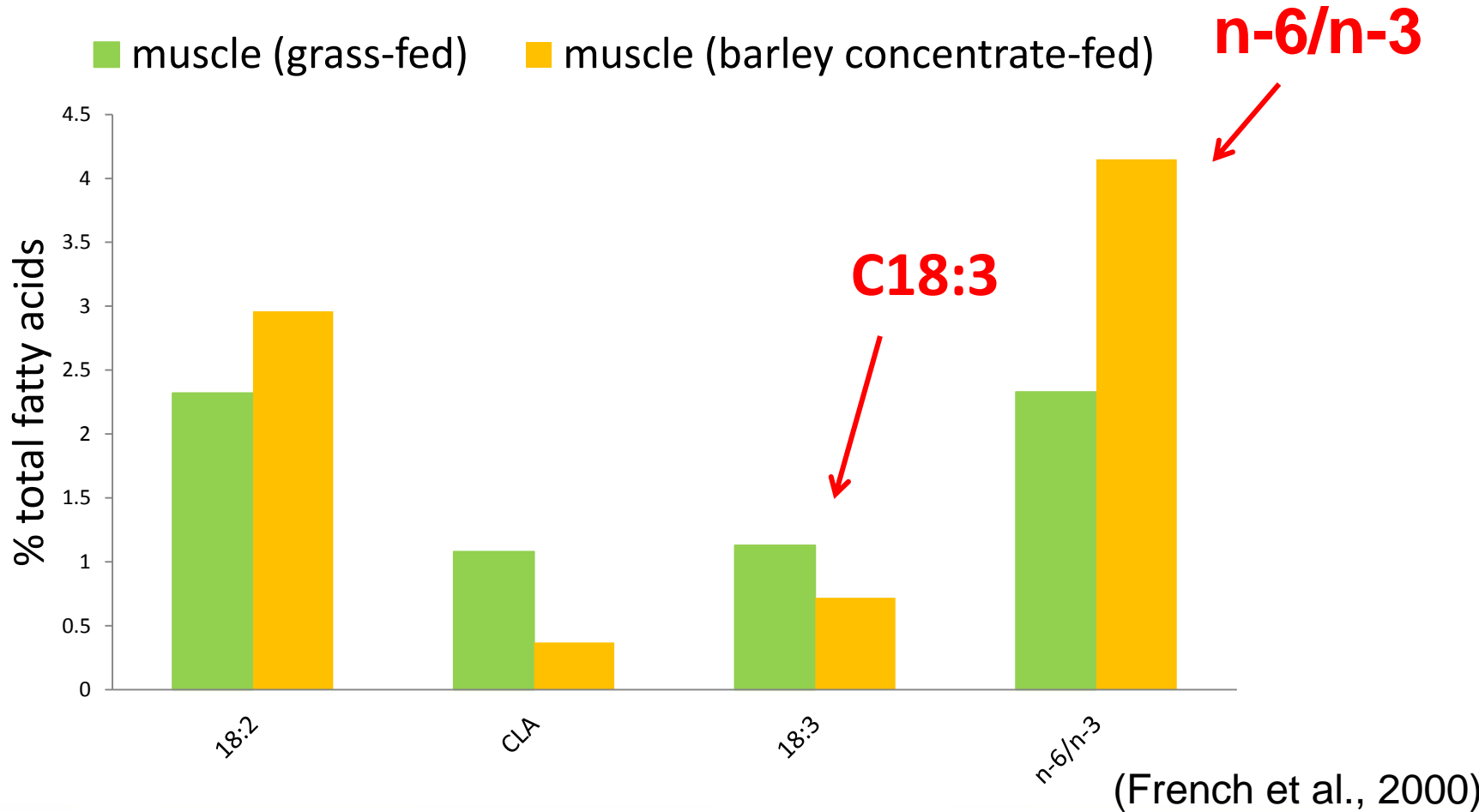
Strategies to increase omega-3 PUFA in beef

- Supply PUFA
- Supply PUFA, inhibit ruminal biohydrogenation
- Supply protected PUFA
 - Chemical
 - Encapsulation

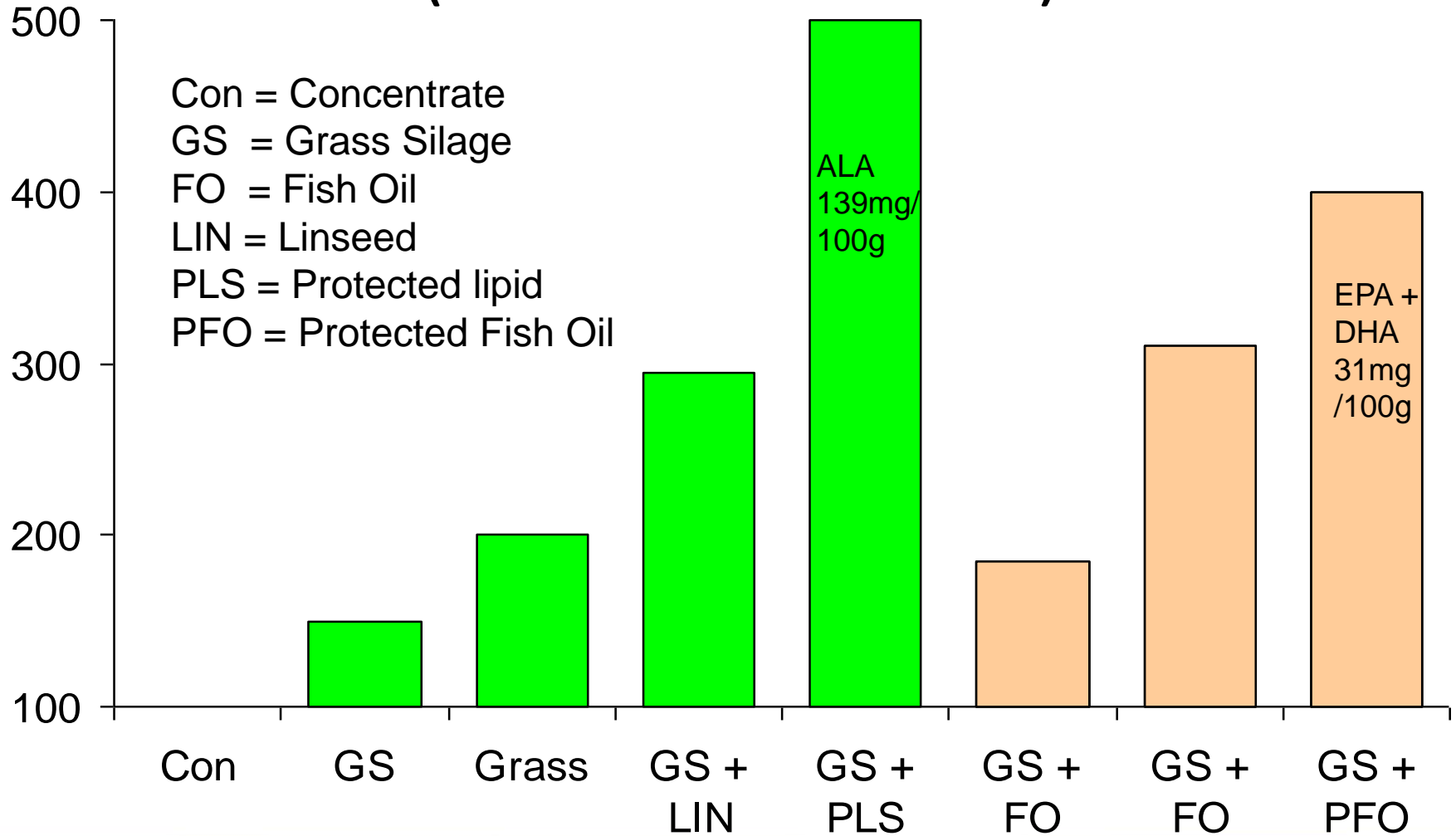
Sources of dietary fatty acids

- Forages - grass 60% alpha-linolenic acid (C18:3 n-3)
- Oils and oilseeds
 - rapeseed C18:1n-9 oleic acid
 - sun/safflower C18:2n-6 linoleic acid
 - linseed C18:3n-3 alpha-linolenic acid
- Fish oil and marine algae - long chain EPA and DHA

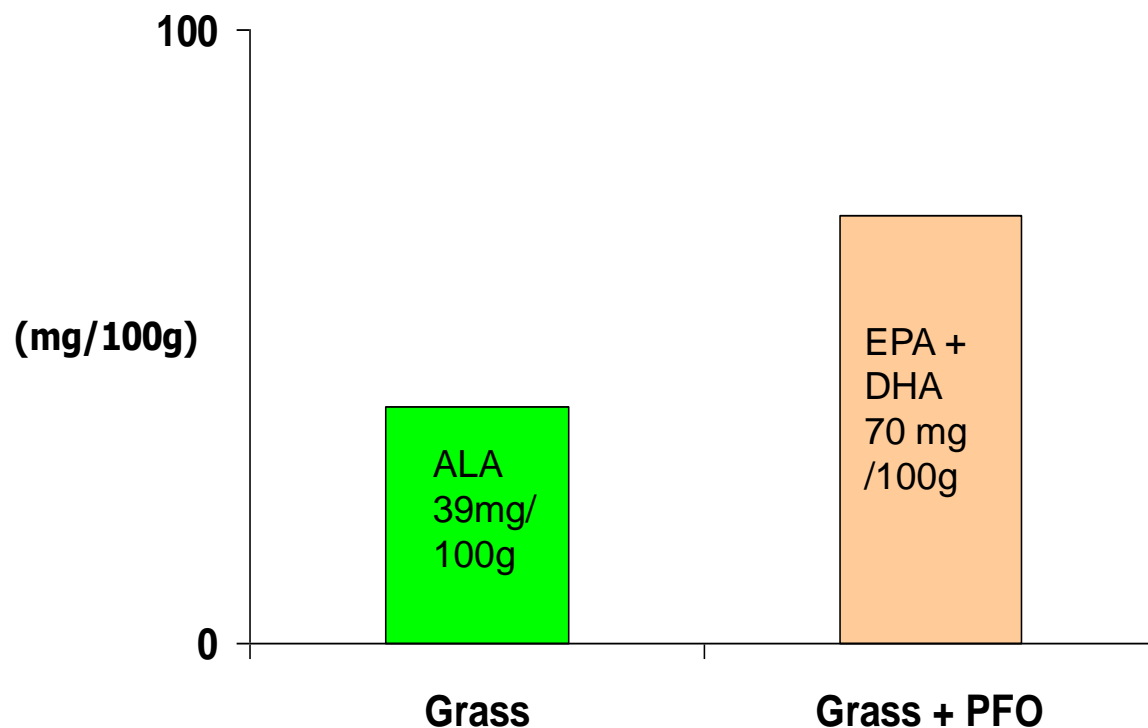
Meat fatty acids



Omega-3 PUFA concentrations in beef (Concentrate = 100)



Omega-3 PUFA concentrations in beef



(Moloney *et al.*, unpub)

- Source of omega -3 fatty acids

300mg “grass” ALA/100g and / 100 kcal

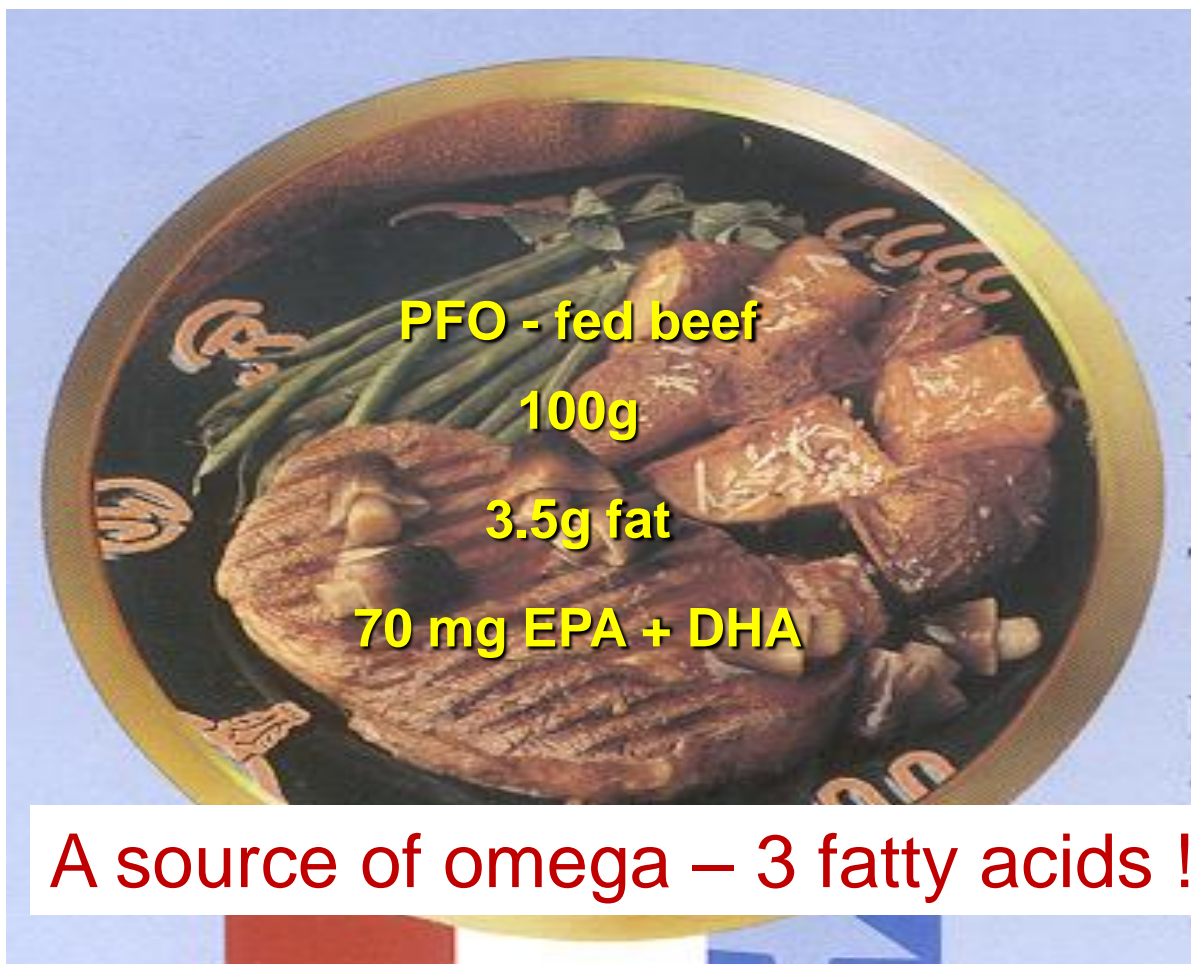
40mg “marine” EPA +DHA/100g and 100 kcal

- High in omega -3 fatty acids

600mg ALA/100g and 100 kcal

80mg EPA + DHA/100g and 100 kcal

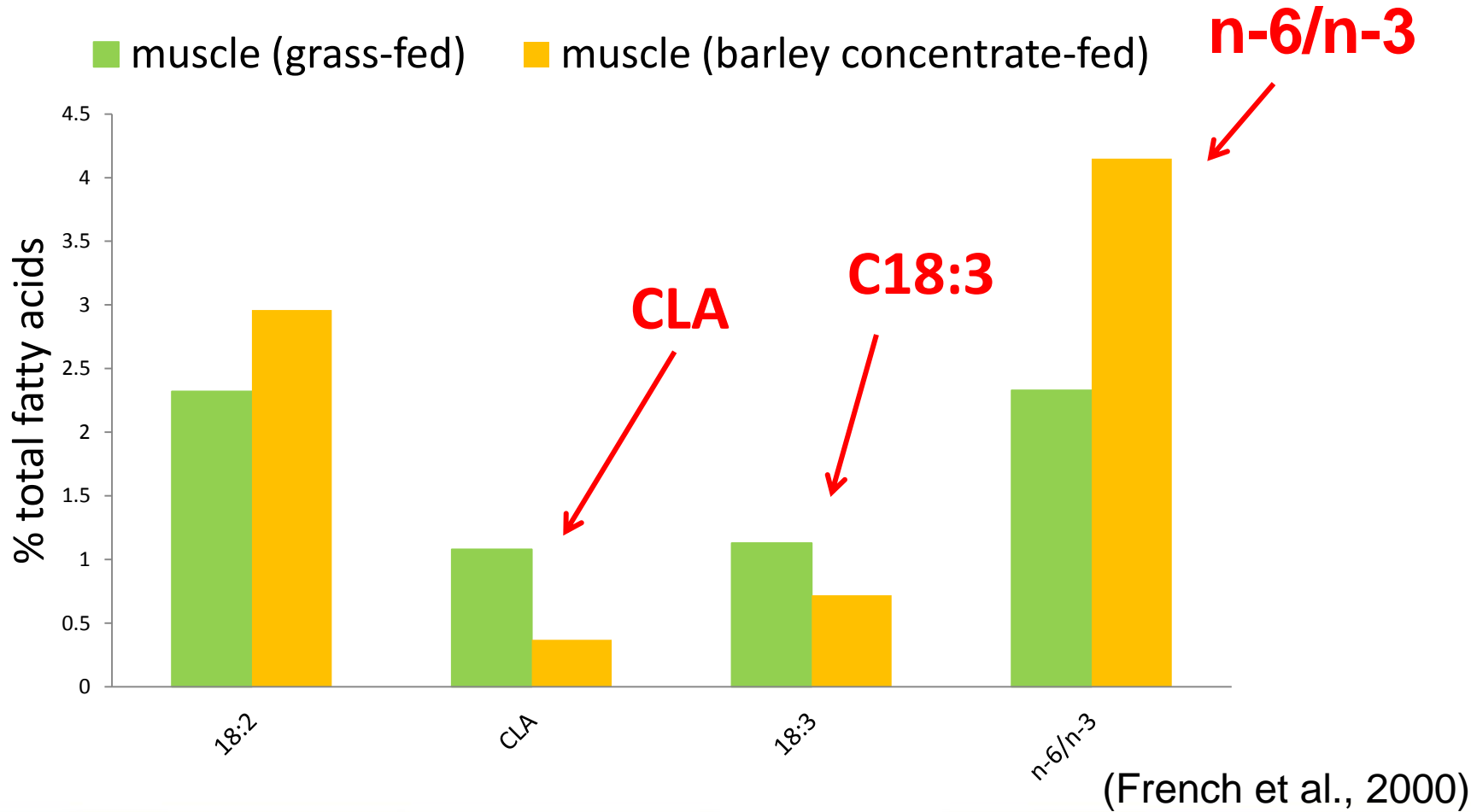
Commission Regulation (EU) No. 116/2010



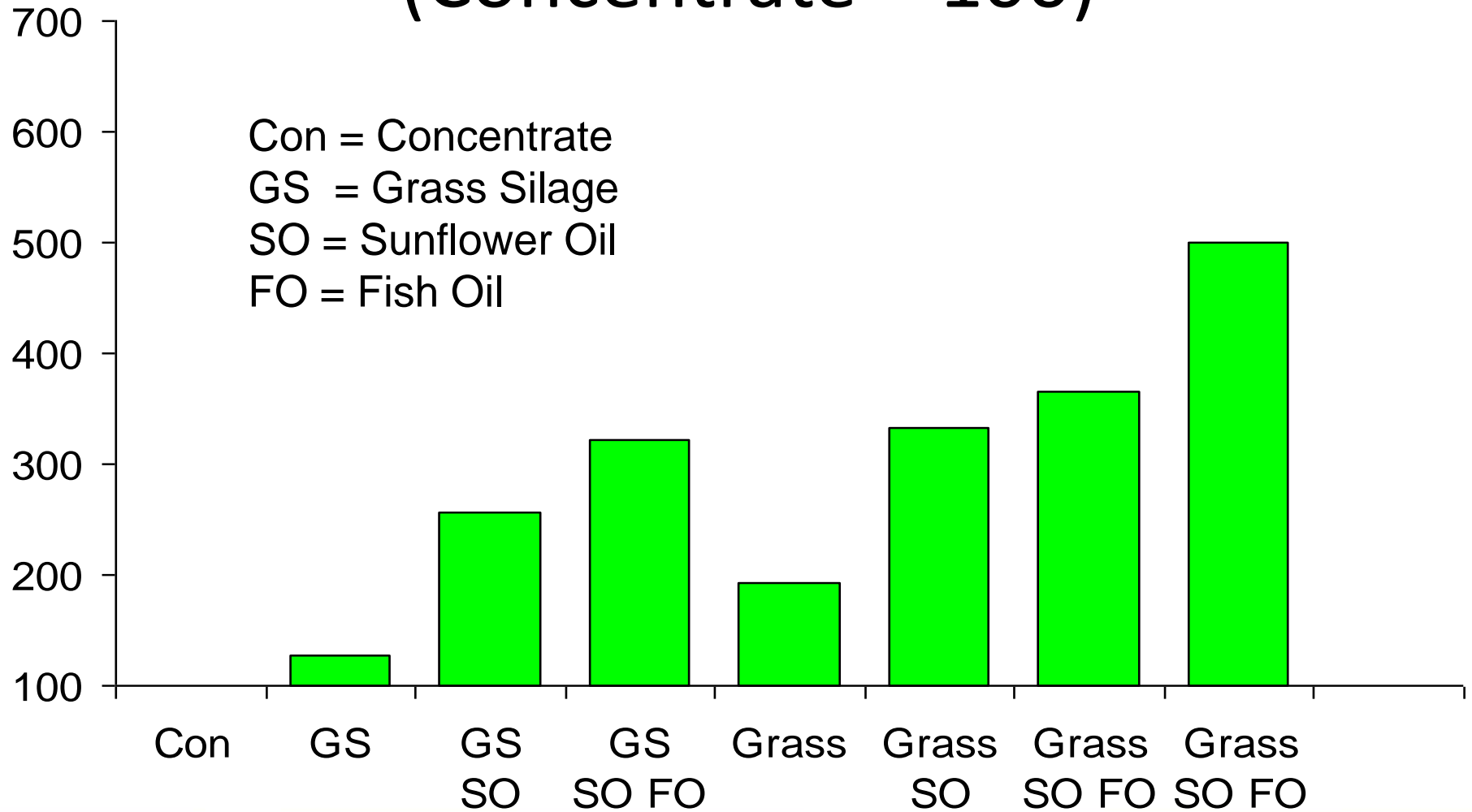
Strategies to increase CLA in beef

- Supply PUFA, control ruminal biohydrogenation
- Increase vaccenic acid in the rumen
- Increase tissue desaturase activity
- Supply protected CLA

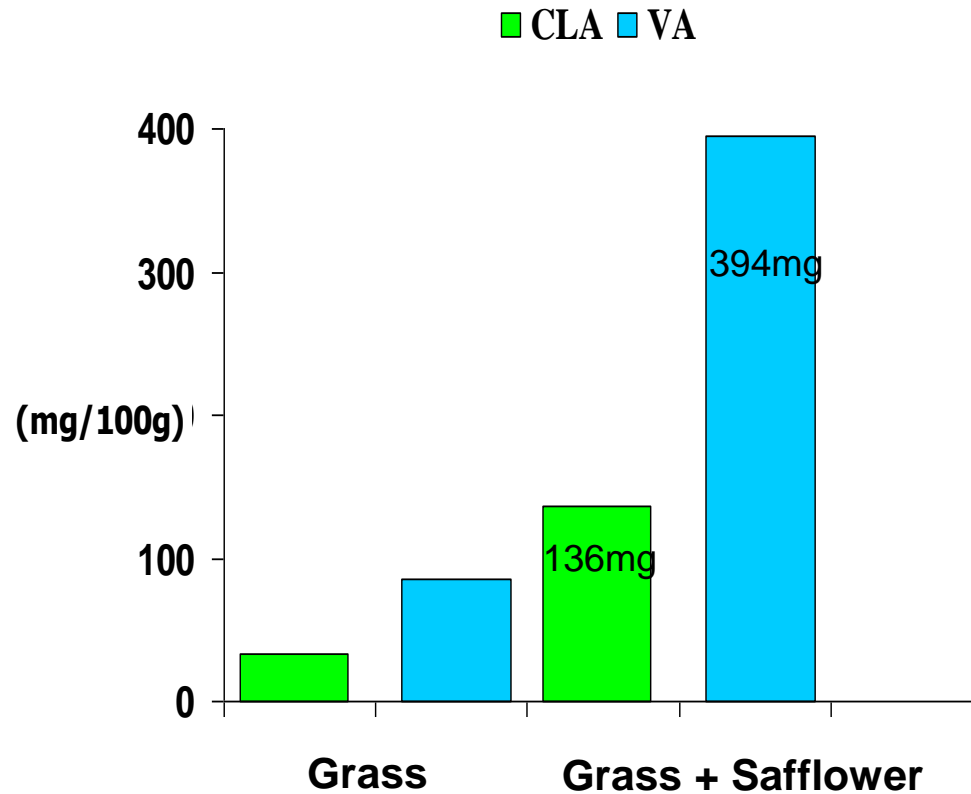
Meat fatty acids



CLA concentrations in beef (Concentrate = 100)



CLA and vaccenic acid concentrations in beef



(Moloney *et al.*, unpub)

Recommended daily allowance

Unknown!

- Based on animal studies :
- 1.5 - 3g/day for cancer protection

May be lower in humans !

- Other disease states?



Nutritional quality of beef

- (Dietary effects on muscle fatty acid composition greater than breed effects)
- Muscle fatty acid composition reflects dietary composition: effects are small!
- Nutritional quality (omega-3) can be enhanced by supplementation with lipid: greatest effect seen with ruminally–protected lipid
- Increased CLA concentration due to oil supplementation may be associated with an increase in (healthy?) *trans* fatty acids

Conclusion

- Nutritionally enhanced beef can be a component of a healthy diet for the consumer

Challenge to industry!

How to market this concept?

Chicken with omega 3 from an enriched diet

We are introducing UK's first chicken as a source of omega 3, which as a key part of a balanced diet, help maintain normal heart, brain and vision function.



a source of
omega 3 for heart,
brain & vision



Waitrose UK

http://www.waitrose.com/home/inspiration/about_waitrose/about_our_food/omega-3-chicken.html