

NUTRITIONAL INTEREST OF SATURATED FATTY ACIDS :

ORIGIN, METABOLISM AND BIOLOGICAL FUNCTIONS

Pr. Philippe LEGRAND

**Laboratoire de Biochimie et Nutrition Humaine
ENSA - INRA, Rennes**

Copenhagen, September 09

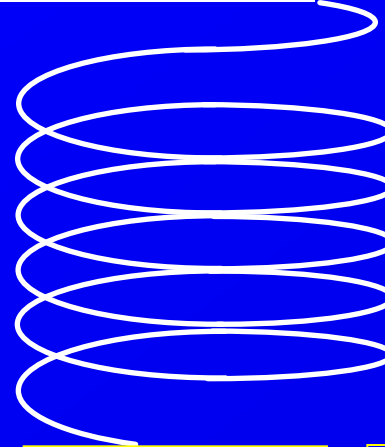
SATURATED FATTY ACIDS

- **We make them**
- **We eat them**
- **Important functions**
- **Problems**
- **Dairy products**

We do synthesize them :
(human, animal, plant...)

Sugars, Starch, Alcohol.....

synthesis

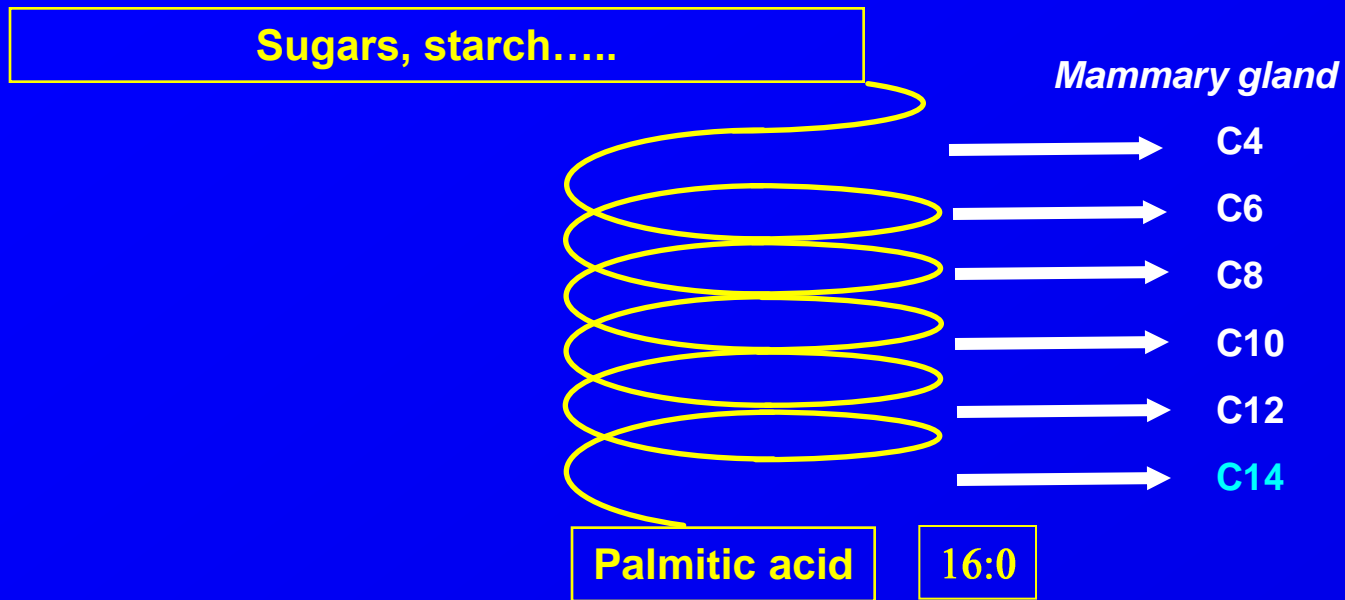


Palmitic acid 16:0

elongation

Stearic acid 18:0

Mammary gland synthesizes the short and middle chain saturates



SATURATED FATTY ACIDS

- We make them
- **We eat them**
- Important functions
- Problems
- Dairy products

CONSUMPTION IN FRANCE

	Men	Women	Total
Lipids (g/day)	103,0	81,6	91,8
Lipids (%Energy)	38,8	39,8	39,3
Saturated Fatty Acids (%En)	15,8	15,9	15,9

AET : Apport énergétique total

Source: INCA 2

SATURATED FATTY ACIDS

- We make them
- We eat them
- **Important functions**
- Problems
- Dairy products

Saturated fatty acids functions

(in addition to energetical function)

C4 butyric

C6 caproic

C8 caprylic

C10 capric

C12 lauric

C14 myristic

C16 palmitic

C18 stearic

C20 arachidic

C22 behenic

C24 lignoceric

- Inhibition of tumor proliferation *in vivo* and *in vitro*
- Induction of apoptosis
- Colon and smooth muscle cells
- Weight reduction
- Less fat deposition (- 23% adipose tissue)
- C8 ↓ VLDL secretion (inhibition of apo B synthesis)
- Hypocholesterolemic effect (C8, C10)
- Antiviral role
 - Specific acylation of proteins
- Accumulation (exogenous + endogenous acids)
 - Activation or conversion from C18:3 n-3 to EPA + DHA
- Low elongation of polyunsaturated fatty acids synthesis
- 1-7% of total polyunsaturated fatty acids
- Active desaturation to oleic acid
- Component of sphingolipids
- « non specific » acylation of some proteins
- Nervous structure (myelinisation)

So.....

➔ No reason for considering SFA “en bloc” anymore,

- in term of structure

- in term of metabolism

- in term of cellular functions

- and in term of deleterious effect ?

SATURATED FATTY ACIDS

- We make them
- We eat them
- Important functions
- **Problems**
- Dairy products

Myristic Acid Dose-effect studies

hamster:

- no increase of LDL-cholestérol
- Increase of HDL-cholestérol

(Loison et al., 2002 a et b)

Human

- Increase of HDL-cholestérol

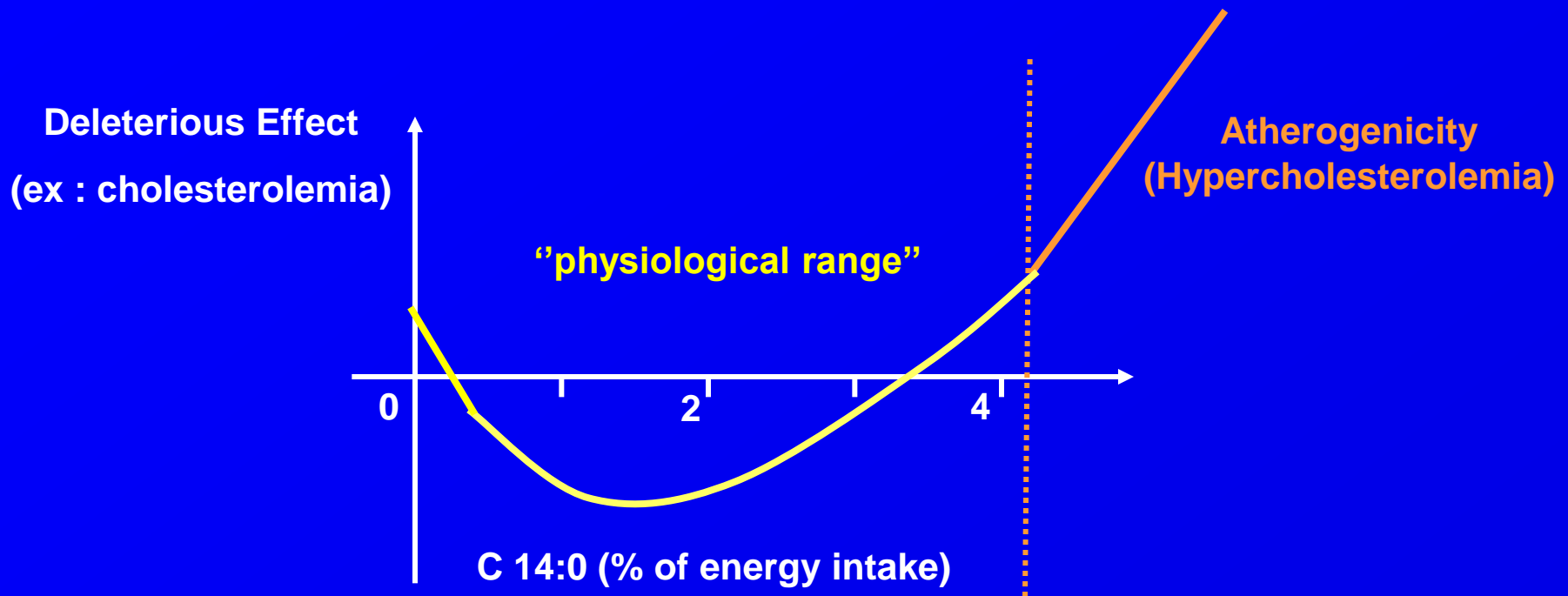
(Tholstrup et al., 1994, 2003)



Suggest physiological range

DOSE-EFFECT OF MYRISTIC ACID ON ATHEROGENESIS

Example of cholesterolemia in hamster and human



Tholstrup et al., 1994; Loison et al., 2002 a et b; Tholstrup et al., 2003

- NO HYPERCHOLESTEROLEMIC EFFECT OF **SHORT AND MIDDLE CHAIN SFA**

Hu et al., 1999

- NO HYPERCHOLESTEROLEMIC EFFECT OF **STEARIC ACID**

Yu et al., 1995

- **ATHEROGENIC SFA IN CASE OF EXCESS : C12, C14, C16,**

Kris-Etherton and Yu, 1997

A LOT OF OTHER POSITIVE DATA WITH SFA IN HUMAN

➤ Coagulation and fibrinolysis,

Tholstrup et al., 2003, Am. J. Clin. Nutr.

➤ Atherosclerosis

Mozzafarian et al., 2004, Am. J. Clin. Nutr

Reviews, Editorials.....

- The questionable role of saturated and polyunsaturated fatty acids in CVD

Ravnskov U., 1998

- Saturated fat prevents coronary artery disease? An american paradox

Knopp H and Retzlaff B., 2004

- Has the association between saturated fatty acids, serum cholesterol and coronary heart disease been over emphasized?

Parodi P., 2009

CONCLUSION - SUMMARY

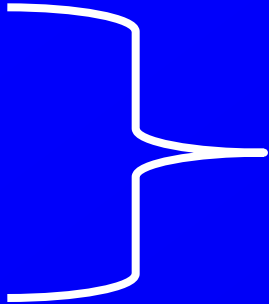
- No reason for considering SFA “en bloc” anymore, in term of **structure** and **metabolism**, in term of **functions** and in term of **deleterious effect** as well.
- Need of more precise epidemiological studies (different saturated fatty acids, dose-effects approach, controls...) for the deleterious effects
- Time for up to date recommendations without caricatural old statements of toxicity or eviction

SATURATED FATTY ACIDS

- We make them
- We eat them
- Important functions
- Problems
- Dairy products

- Dairy products account for 34% total SFA (only !!!) (France)
- SFA from dairy sources have an interesting composition (13% short and middle chain)
- SFA from plant origin have a poor composition (long chain)
- SFA from plant origin are less « visible » and cheaper
- The health concern is the excess of C12,C14,C16

COMPARATIVE COMPOSITION OF SFA

	Dairy products	« plant fat » (from palm)
C4 butyric		
C6 caproic		
C8 caprylic		13-15 %
C10 capric		
C12 lauric	3,5 %	
C14 myristic	10 %	
C16 palmitic	23-32 %	46-62 %.... *
C18 stéaric	13 %	6 %.... *

SFA qualitative value	+ + +	- - - *
SFA content :	52-70%	52.....100%

* Worst if hydrogenation

CONCLUSION FOR DAIRY SOURCES OF SFA

IF THE TOTAL SFA INTAKE SHOULD BE REDUCED, OR MORE SERIOUSLY IF THE ATHEROGENIC (when in excess) SFA SHOULD BE REDUCED

THEN :

- 1) CONSIDER THE DAIRY / VEGETAL ORIGIN OF SFA.
- 2) DAIRY PRODUCTS ARE NOT THE GOOD TARGET **QUALITATIVELY**
- 3) DAIRY PRODUCTS ARE NOT THE UNIC TARGET **QUANTITATIVELY**

Thanks for your attention