What Shall I Eat? => RNI

Recommended Nutrient Intakes

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Lesson : **http://Corpet.net/Denis**

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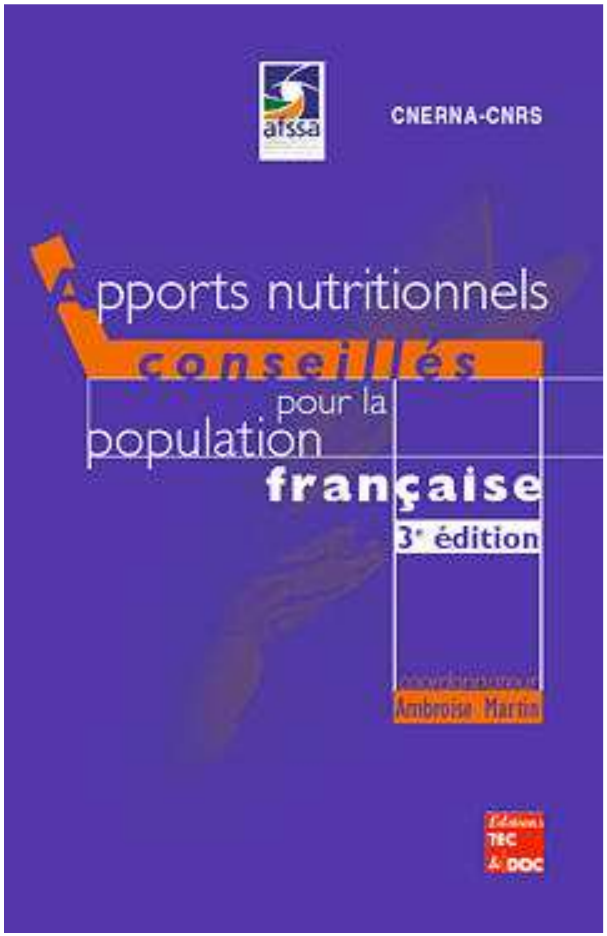
RNI
Lesson Content

- Recommended Nutrient Intake, Why?
- **To Fulfill the Nutritional Needs** (Needs = Requirements)

  How can RNI be used, and for whom?

  Nutrients, how much to get enough?
- **To Reduce Disease Risk**

  - How do we know?
  - Which Diseases could be induced/prevented by diet?



ANC Lavoisier TEC&DOC

Recommended **N**utrient **I**ntakes

RNI, **Definition**

- Advices given to a population
- To help dietary choices, so that the diet contains enough of all needed nutrients (no deficiency)
- To reduce the risk of chronic diseases (no excess, no imbalance)
- RNI = Recommended Nutrient Intakes
- RDA = Recommended Daily Allowance
- ANC = Apports Nutritionnels Conseillés
- AQR = Apports Quotidiens Recommandés

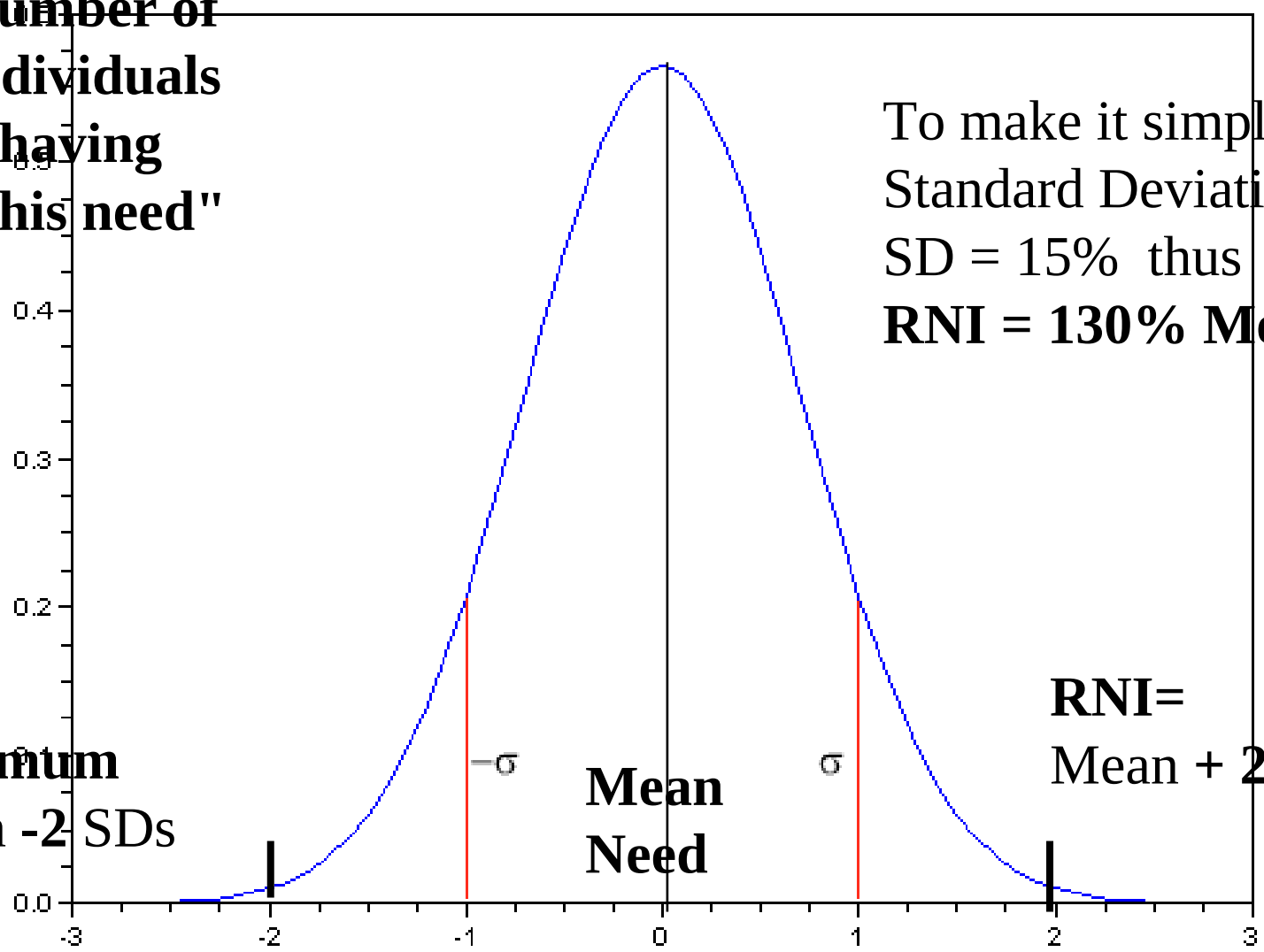
RNI are **important**

- To prevent morbidity (diseases) & mortality (no deficiency, no excess, no imbalance)
- To make economical & political choices
  - Agricultural production, importations, taxes, prices, advertising
  - International conferences, country status (FAO/WHO => UNO, Third World debt)

Fulfill the Needs (1)
How to use RNI?

- RNI Target population : « normal » people
- Population (not individual): *Statistics!*
  To meet everyone needs,
  one must give too much to most people:
  Is this a waste?

Nutrient Needs



To make it simple:
Standard Deviation
SD = 15% thus
RNI = 130% Mean

Minimum
Mean **-2** SDs

RNI=
Mean + **2** S.D.

Fulfill the Needs (2)

What might change people's needs?

- Needs change according to **Body Weight**
  => RNI are given in **g/kg** (*specific RNIs based on kCal*)
- Some needs depend on **Gender**

= e.g., women need more iron, folates, calcium

- Needs depend on **Age**:
  = Kids growth (protein, calcium).
  = Seniors: *which needs are specific?*

Iron needs (**Fe**)
Women ≠ Men

- 0-8 years: 7 mg/day
- 8-12 year: 8 mg/day
- Teenagers: 12 mg/d boy - 14 mg/d girl

- **Adult male: 9 mg/d**
- **Adult female: 16 mg/d** (9 mg post-menopause)
- Pregnant woman : 25-35 mg/d from 4 to 9 months of pregnancy (need supplements after 1er term)
- Breastfeeding woman : 10 mg/d

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Protein RNI g/kg/d
Changes with **Age**

2.6 g/kg at 1 month

2.1 g/kg at 2 months

1.7 g/kg at 3 months then progressive decrease

1.0 g/kg à 2 years (& pregnant/milking woman)

0.9 g/kg between 2 & 18 years

0.8 g/kg adult. Good quality proteins
(minimum 1/3 de animal proteins)

1.0 g/kg seniors (old-timers)

Minimal needs: 0.5 g/kg/day

Kids' needs are well known. **Seniors**' ones are mostly **unknown!**

Fulfill the Needs (3)
How to use RNI?

Target « **normal** » people, and advices for a **population** (not individual): *Statistics!*
Needs depend on **body weight**, on **gender**, on **age**

- **Adaptation** : Needs depend on Diet!
  water, calcium, proteins,…the more you eat, the more you reject
- **Time scale**:
  - Balanced food, balanced meal, balanced week, …?
  - There is no ideal food (*How to advertise?*)
  - Balance is obtained on several days (*How to make menus?*)

NextSlide: **Q.** How to measure needs**?**
Survey= empirical / Balance= factorial)

How to Know the Needs?
Three Evaluation Methods

- **Empirical** method: To observe what a healthy (or an overtly deficient) population is eating
- **Factorial** method: Balance (intakes vs. outputs)
  = (expenses, measured experimentally)
  = (maintenance + activity + growth) E.g., protein needs from N losts
- **Depletion/Repletion** method:
  Exp. determinat. of minimal intake following a deficient diet
- **Criterion?** Balance (N, K), blood level (Iron, Vitamins), Biomarker (homocystein for folic acid)
  - **No method is perfect, nor precise, nor universal**
  - **RNI are thus temporary and rough (approximated)**

Fulfill Nutrient Needs: Major nutrients

- **Water**
- **Energy /Calories**
- **Proteins**
- **Fats**
- **Carbohydrates**
- **Minerals**
- **Vitamins**

Fulfill Nutrient Needs:

Eat What, and How Much, to Get Enough?

- **Water**: control = thirst (good example of balance problem)

Water : input-output

Input	**2,300 ml**	**Output**	**2,300 ml**
Drinks	1,100	Urine	1,400
Metabolic w	300	Fecal water	100
Food water	900	Breath	500
		Sweat	300

Fulfill Nutrient Needs:

Eat What, and How Much, to Get Enough?

- **Water**: control = thirst (good example of balance problem)
- **Energy /Calories**: control = hunger
  Best control: Body weight, BMI stability.

Recommended **Energy** Intakes

Sources: **fat 9**, carb. **4**, prot. **4 kCal/g**

Median need: **2 400 kCal/d** (=how many grams of carbohydrate?)

1800 kCal/d sedentary woman

3400 kCal/d very active man

Many different systems to determine energy intake:
f(age, weight, physical activity…) equations, tables, software

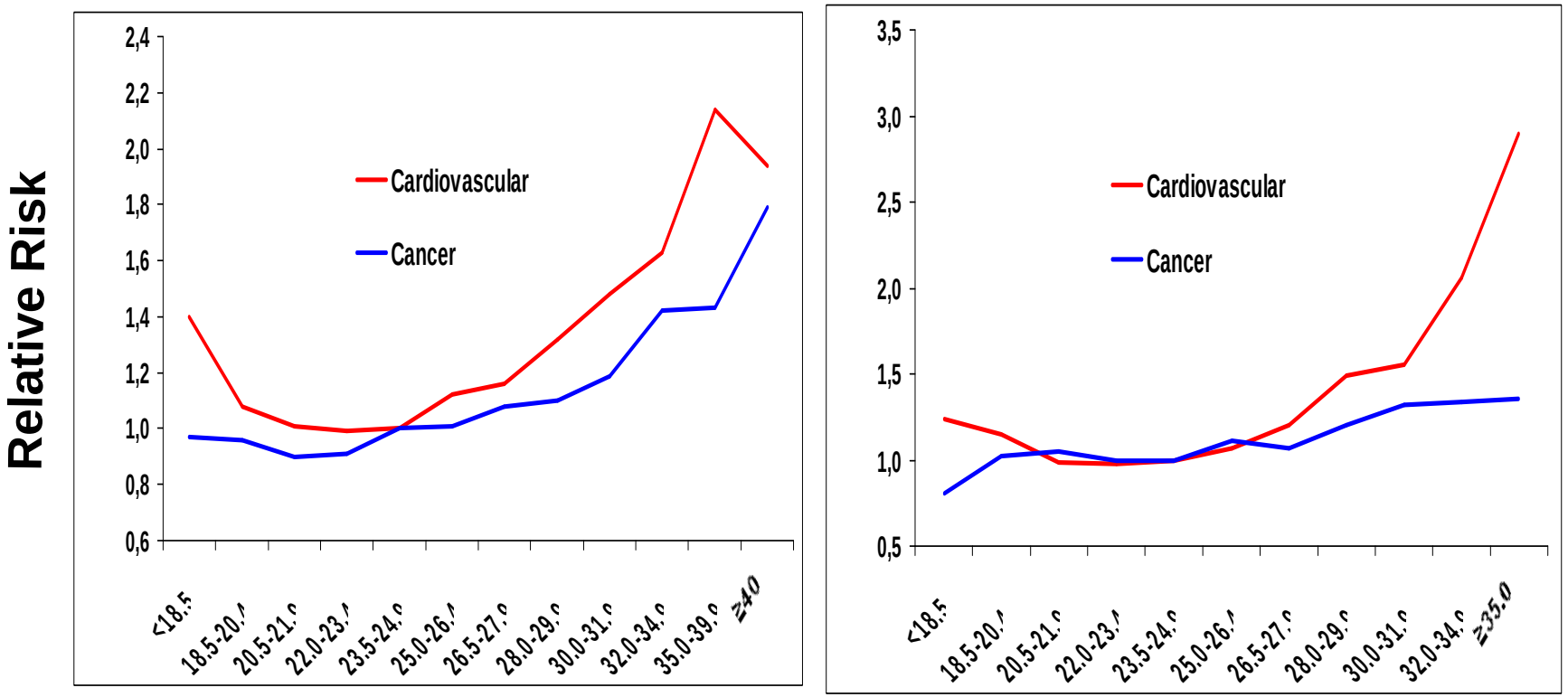
Primary control: appetite/satiety (often overcome)

Secondary control: stable body weight

Optimal **Body Mass Index**, = BW/H^2 **BMI [19-25]** kg/m^2

More expenses, High Nutr. Density >> Reduced Calories

Body Mass Index & Death, Women and Men (USA)



E. Calle, NEJM. 1999
Diapo.: Françoise Clavel

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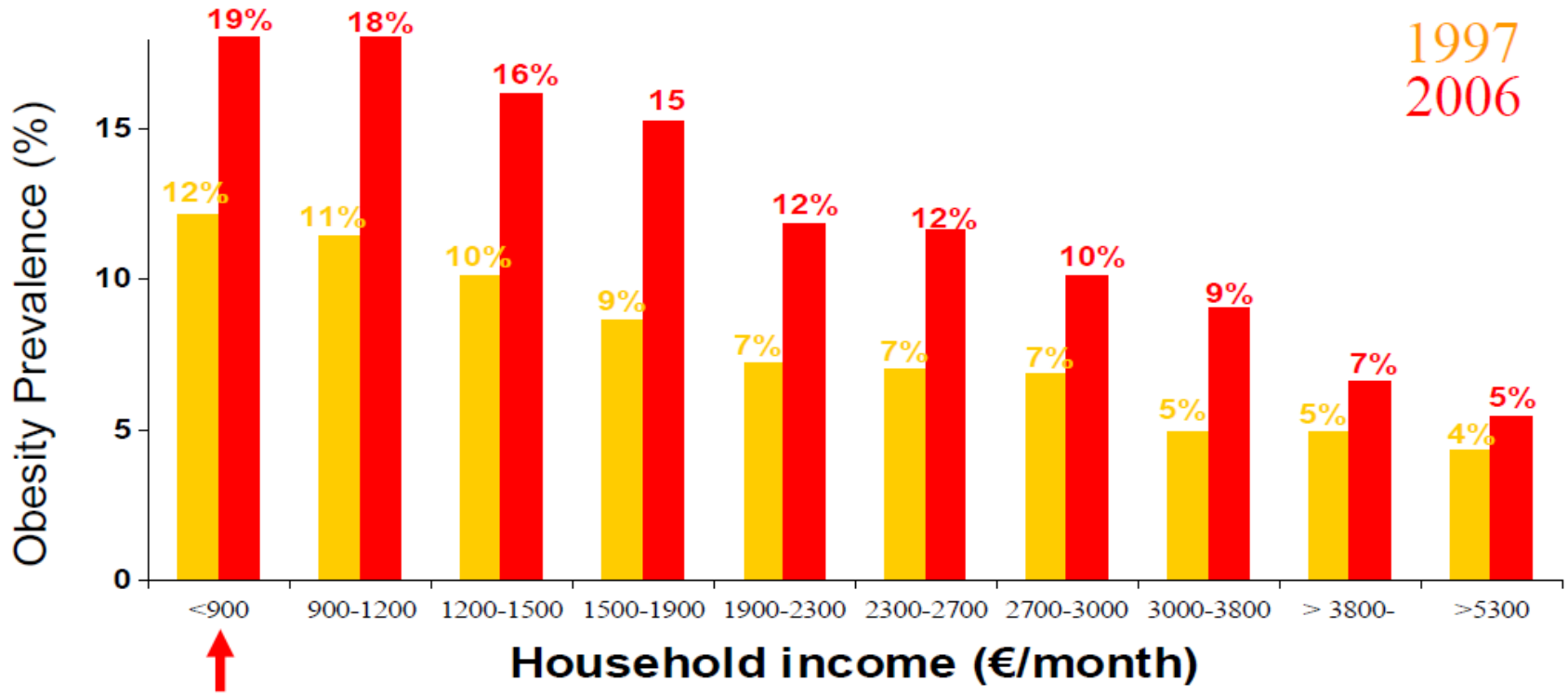
More Obesity in the Poor

France, Obepi survey *(MA Charles, Obesity 2008)*



In France,
hope

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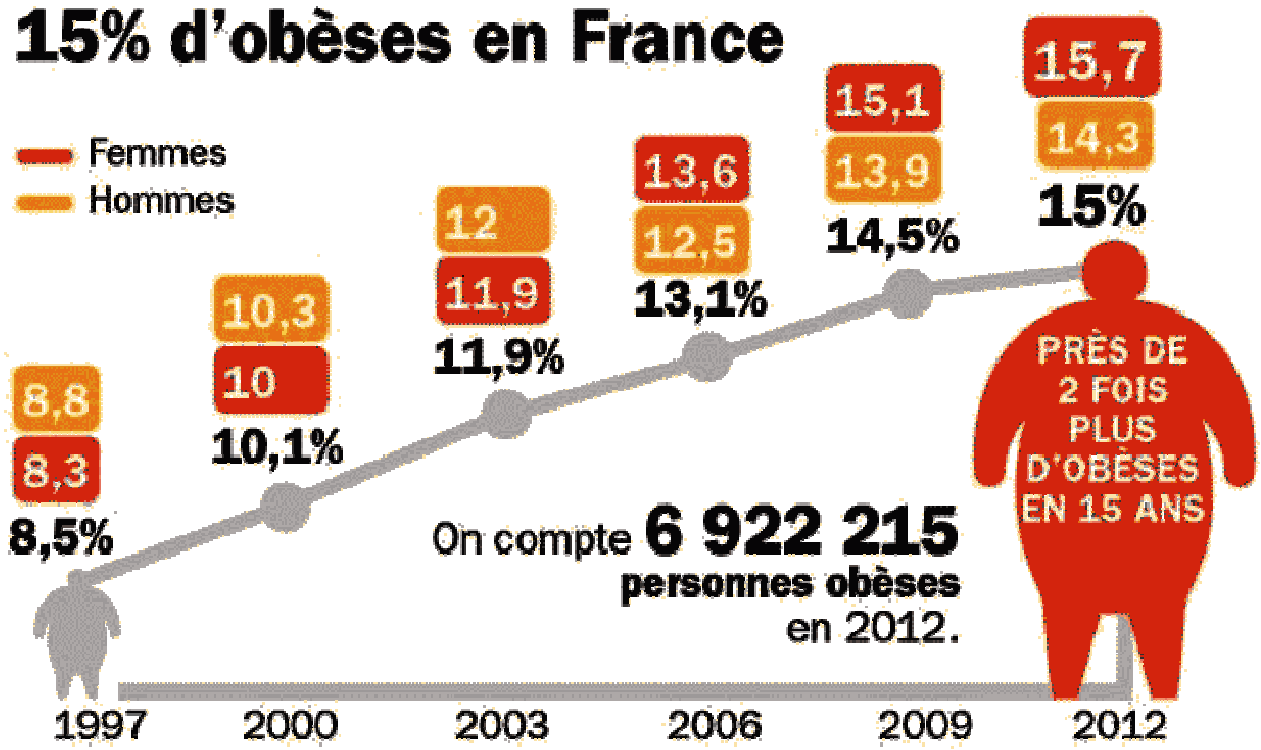
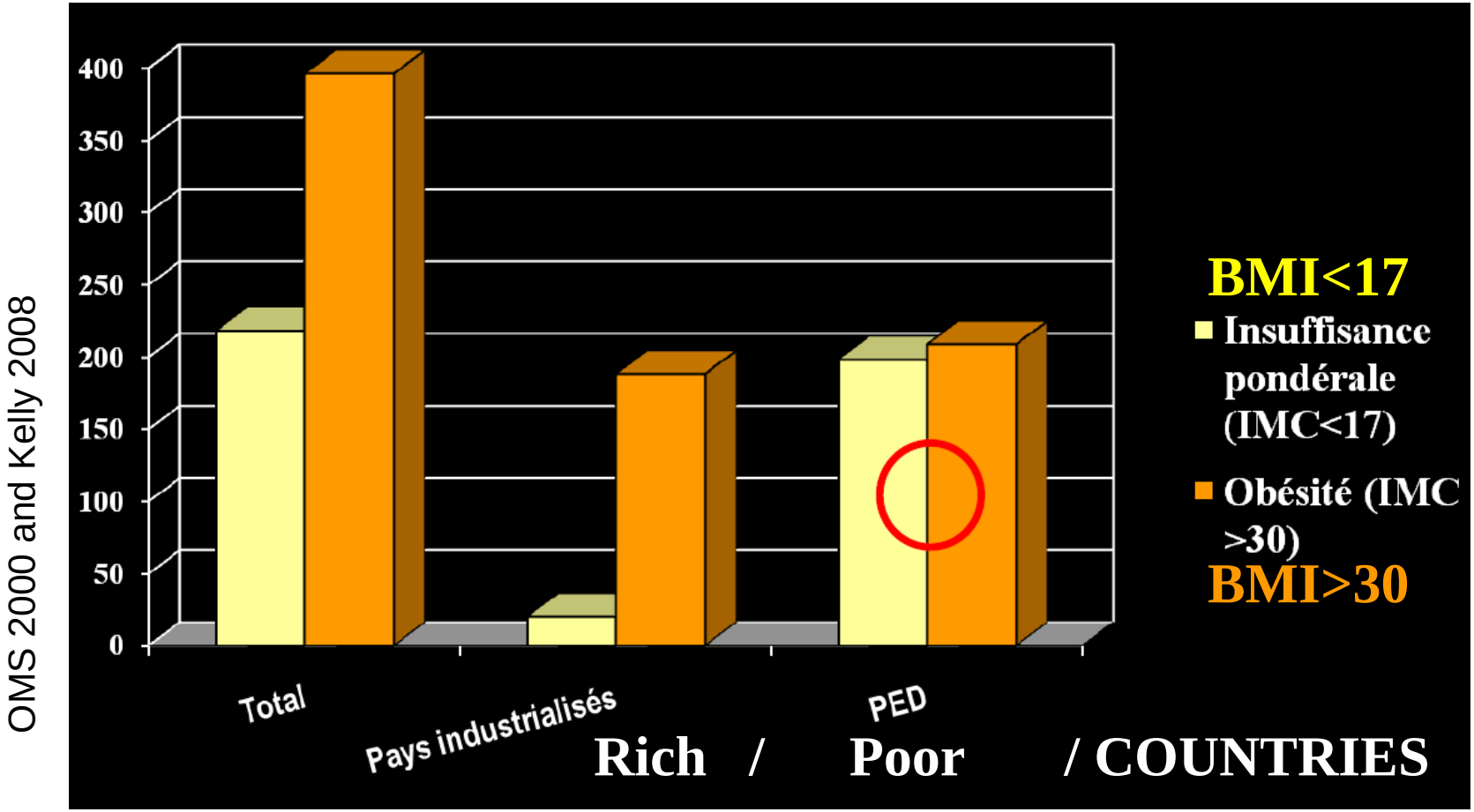
France, a frigthening epidemic, but there is hope



- Adults obesity raise slows down in 2012
- Kids obesity raise stopped in 2000

Developing Countries : Low-Weight **and** Obesity!



Double-Burden: Pre-school kids are too small **and** too fat

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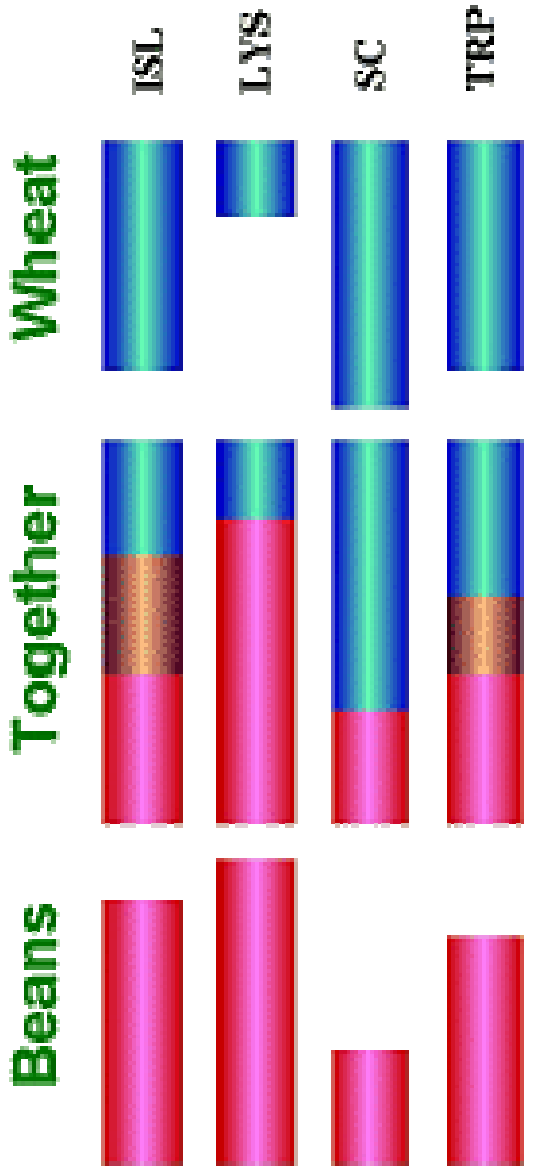
- **Water**: control = thirst (good example of balance problem)
- **Energy /Calories**: control = hunger
  Best control: Body weight, BMI stability.
- **Proteins**: total nitrogen/ Essential Amino Acids
  Biological Value/ complementation
  Where is the control? Is there a specific appetite?

Protein Needs

- Total Protein: 0.6 to **1 g/kg BW/day**
- Essential Amino Acids: N=8
  Leucine, Isoleucine, Phenylalanine, Threonine, Tryptophan, Valine, **Methionine, Lysine**
- Biological Value =
  AA balance (no limiting AA)
  & protein digestibility (fecal Nitrogen)
- AA complementation:
  - Wheat: high SC (Met+Cys), low Lys
  - Beans: low SC (Met+Cys), high Lys



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- **Fats**: Essential Fatty Acids = n-3 & n-6 PUFA

Fat Needs: Lipids

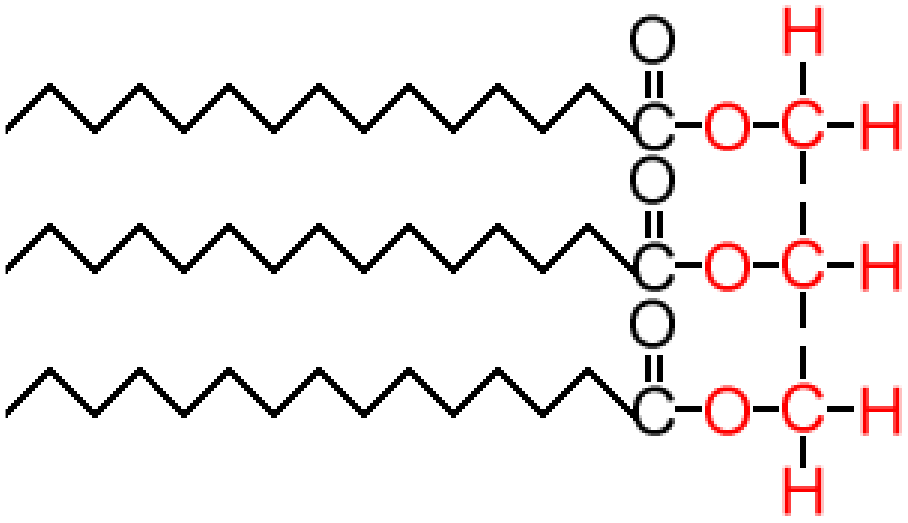
- *Fat bears Calories and fat-soluble Vitamins: A, D, E*
- Three classes of **F**atty **A**cids **:**
  Saturated FA/ **M**ono-**U**nsat. MUFA / **P**oly-**U**nsat. PUFA
- RNI 30-35% calories - **S**fa/**M**ufa/**P**ufa: **10/10/10** 10/10/10
  or the Mediterranean olive oil model : 10/**20**/10
- Essential Fatty Acids: two classes, no conversion

n-6 PUFA =Omega 6, linoleic acid C18:2 n-6: **4% Cal**

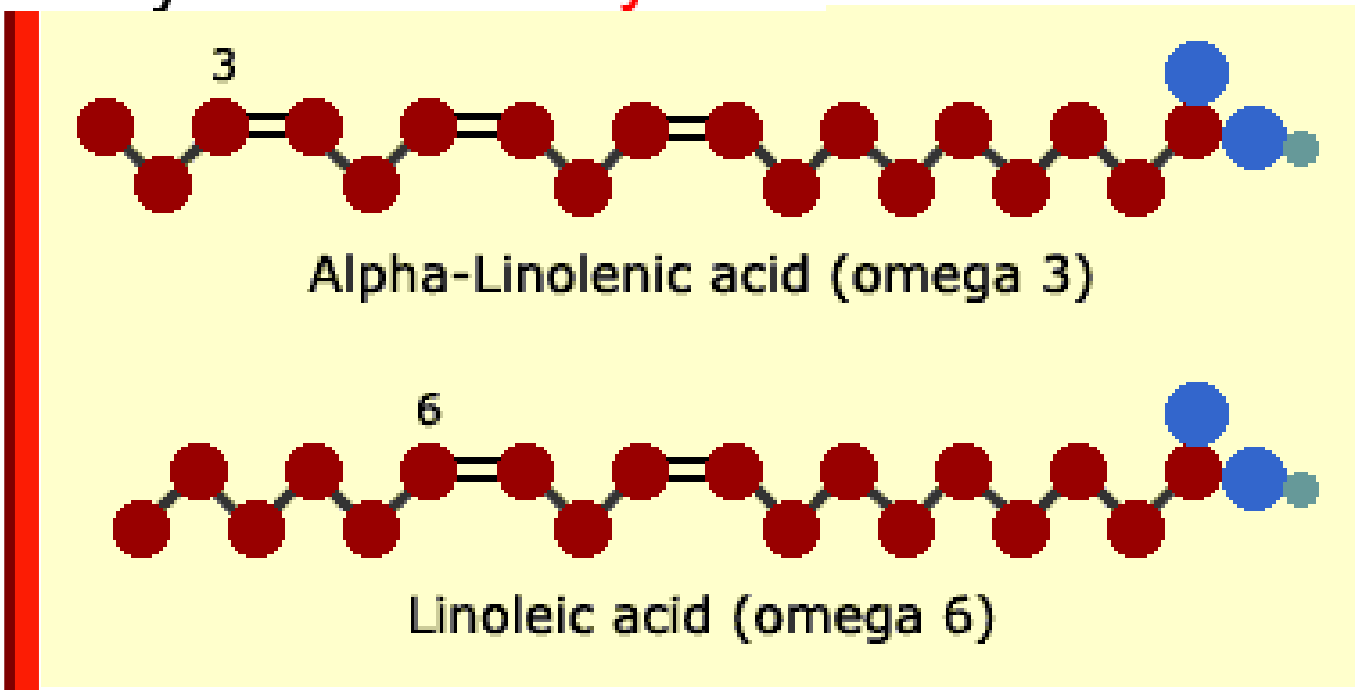
n-3 PUFA =Omega 3, α-linole**n**ic acid C18:3 n-3: **1% Cal**

+ long chain n-3 PUFA (fish oil) EPA+DHA: **500mg**/d

- *n-3/n-6 Ratio usually: 1/20-1/10, but shoud be 1/4*



Fat: Glycerol + 3 Fatty Acids



ω3 oil: canola (rapeseed, colza), soy, fish oils

ω6 oil: corn (maize), sunflower, meat fat.

RNI for fat French AFSSA 2010

Pourcent energy, except EPA & DHA : mg

		BESOIN PHYSIO-LOGIQUE MINIMAL*	PREVENTION DU RISQUE					ANC 2010
			Syndrome métabolique-diabète-obésité	Pathologies cardiovasculaires	Cancers : sein et côlon**	Pathologies neuro-psychiatriques	Autres pathologies : DMLA***	
Lipides totaux[a]		30[b]	30-40	35-40[c]	35-40	35-40[d]	<40	35-40[c]
AG indispensables	Acide linoléique C18 :2 n-6	2	2[e]	5	2[e]	2[e]	≤4[f]	4[g]
	Acide α-linolénique C18 :3 n-3	0,8	0,8[e]	1[h]	0,8[e]	0,8[e]	0,8[e]	1[h]
	Acide docosahexaénoique DHA, C22 :6 n-3	250 mg	500 mg	500-750 mg[i]	500mg	≥ 200-300 mg	500 mg	250 mg
AG non indispensables	Acide eicosapentaénoïque EPA, C20 :5 n-3	-						250 mg[j]
	Acide laurique (C12:0) + Acide myristique (C14:0) + Acide palmitique (C16:0)	-	-	≤8[h]	_	-	-	≤ 8
	Acides Gras Saturés totaux	-	-[k]	≤12	≤12[l]	-	-	≤12
	Acide oléique C18 :1 n-9	-	-	≤20[m]	-	-	-	15-20
	Autres AG non indispensables[n]	-	-	-	-	-	-	-

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- **Fats**: Essential Fatty Acids = n-3 & n-6 PUFA
- **Carbohydrates**: 150g/d glucose brain & 30g fiber
- **Minerals**: Ca (P) (Na) K Mg Fe …
- **Vitamins**: water soluble (B1-9, C, K, PP), fat soluble (A, D, E)

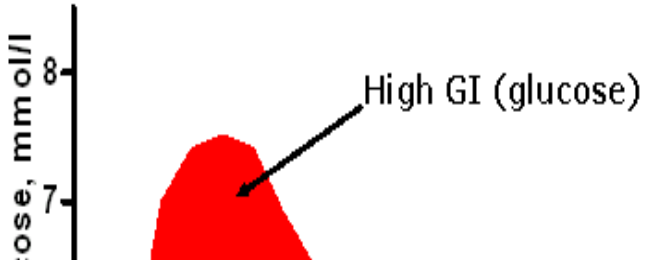
Carbohydrates

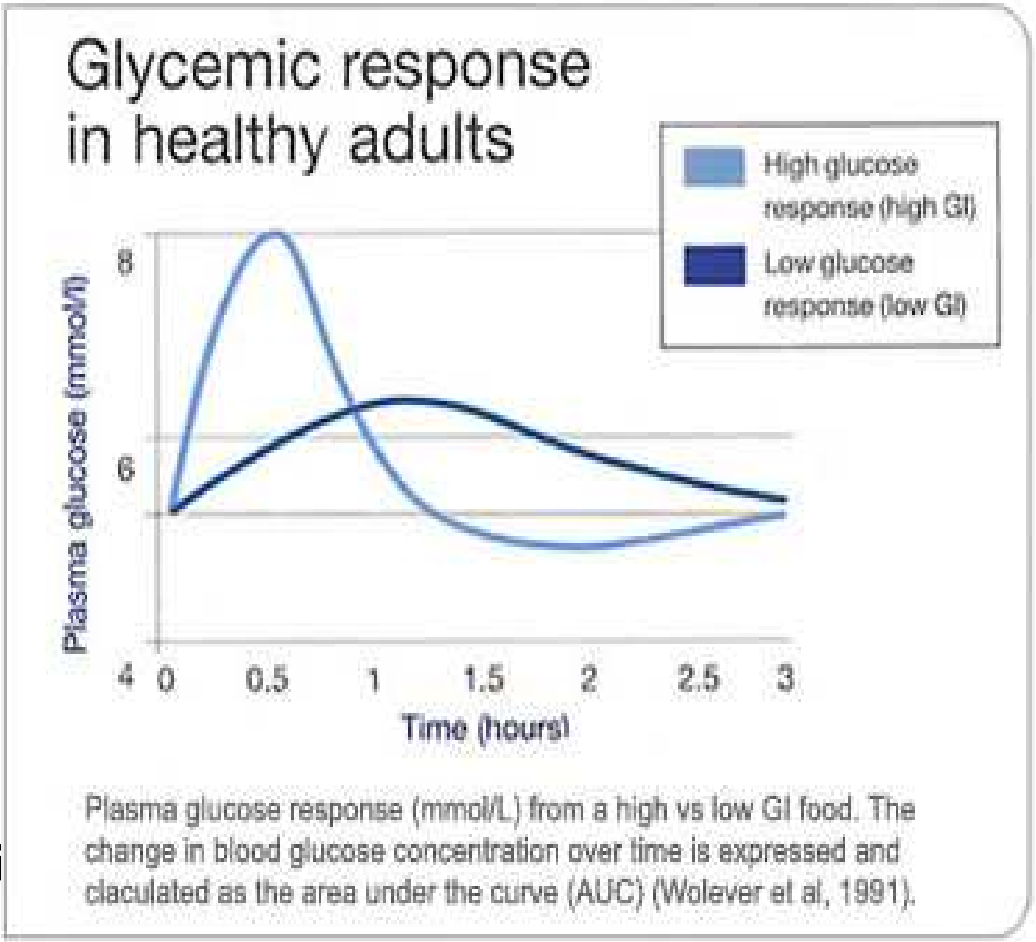
- Little needs 150g/d (brain needs glucose, but liver can make it from proteins, gluconeogenesis)
- Since fat RNI =30% calories, and protein = 15% cal, by difference, Carbohydrate should make **55% cal**. (45 to 60% of calories), **Fibers 25g** to 30 g/d
- « **Slow** » carb. is better, but all starches are not slow
- **Glycemic Index** = blood glucose peak (2h post-meal) Peak Ratio (50g carb.food vs. 50g pure glucose)
    - *Low Glycemic Index is Better!*

No insulin resistance, less diabetes, less obesity…

Glycemic Index

- High GI 80-100: Glucose, white bread, rice, potatoes, corn flakes
- Medium GI 50-80: Noodles, spaghetti, pumpernikel bread, sugar (sucrose)
- Low GI < 50: Beans, lentils, peas, apple, orange, peanuts





Plasma glucose response (mmol/L) from a high vs low GI food. The change in blood glucose concentration over time is expressed and claculated as the area under the curve (AUC) (Wolever et al, 1991).

Deni

Reco-

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Vitamins & Minerals

"Risky" Nutrients (deficiencies)

- Use RNI **tables** (e.g., Canada)
- **Calcium** 1 g/d (more for kids and teenagers),
- **Iron (Fe)** 9 mg/d (twice more for women)
- Vitamin **A** (poor countries: *xeropthalmia blindness*)
- **Iodine** (when far from sea: *mental retardation*)
- Vit. **D** (little sun, dark skin: *rickets*, *bone disease*)
- Vit. **B9** = folates folic acid (pregnant: *spina bifida*)
- Vit. **B12** (vegan, seniors: *anemia*)

Example of RNI table
Recommended Nutrient Intakes (Philippines 2002)

Population group	Weight	MINERALS								VITAMINS				
		Magnesium	Phosphorus	Zinc	Selenium	Fluoride	Manganese	D	E	K	B_6	B_{12}
	kg	mg	mg	mg	mg	mg	mg	µg	mg	µg	mg	µg
Infants, mo												
Birth - < 6	6	26	90	1.4	6	0.01	0.003	5	3	6	0.1	0.3
6 - < 12	9	54	275	4.2	10	0.5	0.6	5	4	9	0.3	0.4
Children, y												
1 - 3	13	65	460	4.5	18	0.7	1.2	5	5	13	0.5	0.9
4 - 6	19	76	500	5.4	22	1.0	1.5	5	6	19	0.6	1.2
7 - 9	24	100	500	5.4	20	1.2	1.7	5	7	24	1.0	1.8
Males, y												
10 – 12	34	155	1250	6.8	21	1.7	1.9	5	10	34	1.3	2.4
13 – 15	50	225	1250	9.0	31	2.5	2.2	5	12	50	1.3	2.4
[illegible]	[illegible]	[illegible]	[illegible]	8.9	36	2.9	2.2	5	13	58	1.3	2.4
19 – 29	59	235	700	6.4	31	3.0	2.3	5	12	59	1.3	2.4
30 – 49	59	235	700	6.4	31	3.0	2.3	5	12	59	1.3	2.4
50 – 64	59	235	700	6.4	31	3.0	2.3	10	12	59	1.7	2.4
65 +	59	235	700	6.4	31	3.0	2.3	15	12	59	1.7	2.4
Females, y												
10 – 12	35	160	1250	6.0	21	1.8	1.6	5	11	35	1.2	2.4
13 – 15	49	220	1250	7.9	31	2.5	1.6	5	12	49	1.2	2.4
16 – 18	50	240	1250	7.6	36	2.5	1.6	5	12	50	1.2	2.4
19 – 29	51	205	700	4.5	31	2.5	1.8	5	12	51	1.3	2.4
30 – 49	51	205	700	4.5	31	2.5	1.8	5	12	51	1.3	2.4
50 – 64	51	205	700	4.5	31	2.5	1.8	10	12	51	1.5	2.4
65 +	51	205	700	4.5	31	2.5	1.8	15	12	51	1.5	2.4
Pregnant women												
Trimester												
First		205	700	5.1	35	2.5	2.0	5	12	51	1.9	2.6
Second		205	700	6.6	35	2.5	2.0	5	12	51	1.9	2.6
Third		205	700	9.6	35	2.5	2.0	5	12	51	1.9	2.6
Lactating women												
1st 6mos.		250	700	11.5	40	2.5	2.6	5	16	51	2.0	2.8
2nd 6 mos		250	700	11.5	40	2.5	2.6	5	16	51	2.0	2.8

http://www.fnri.dost.gov.ph/reni/reni**table**2.htm

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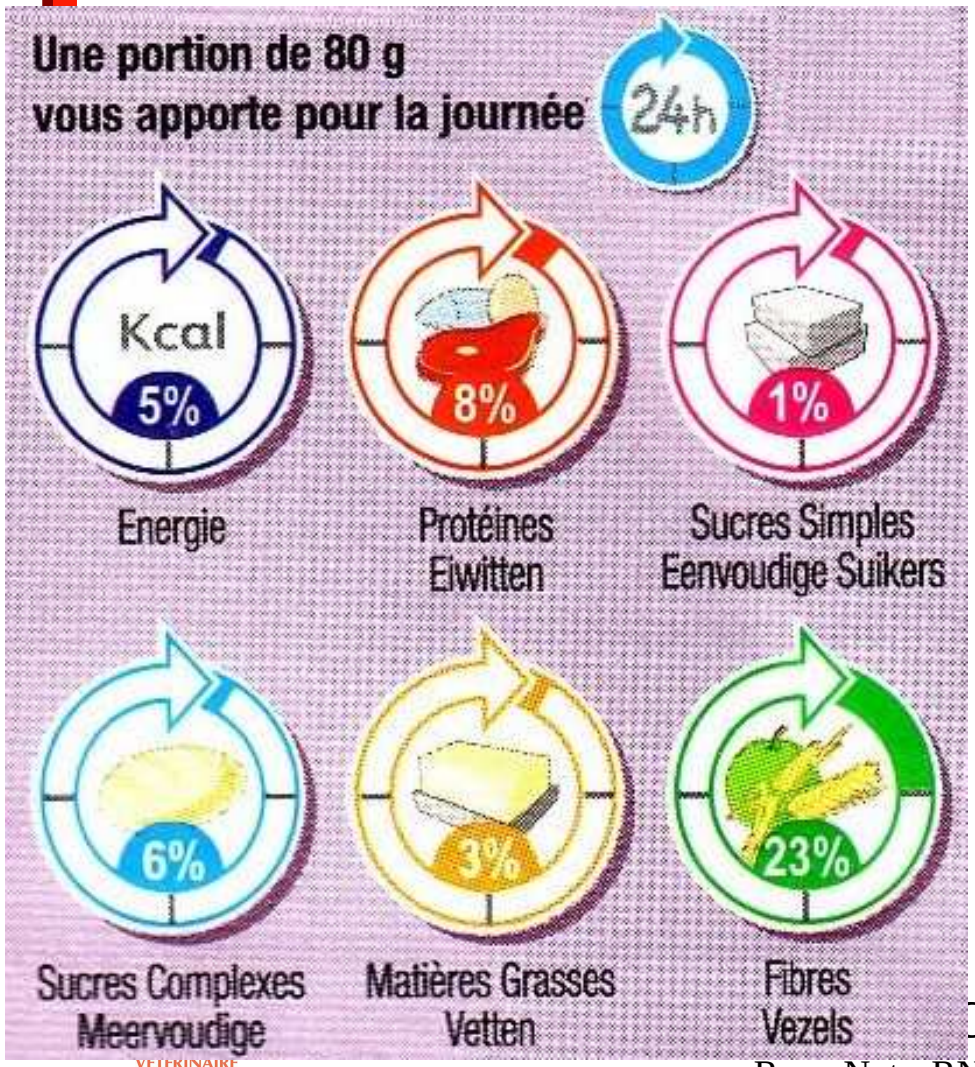
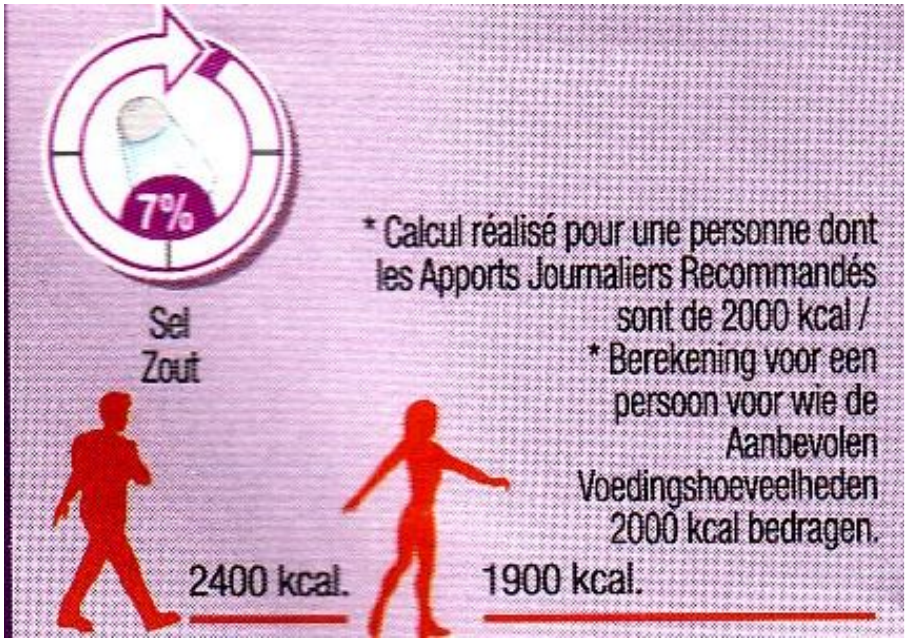
Nutrition Labelling

clocks are easy to understand





How can those complex recommendations be simply **communicated to people**?

- Food Groups (colors):
  milk, **meat**, **fruits & veg.**, **starchy foods**, **fat**
  Plus advices on the number of daily portions

- Pyramid (USA): it often changes!

- Many other systems: the simpler the better !

Food Groups - colors

Blue Group
2-3 per day

Red Group
1-2 per day

Green Group
4-5 per day

Brown Group
Each meal

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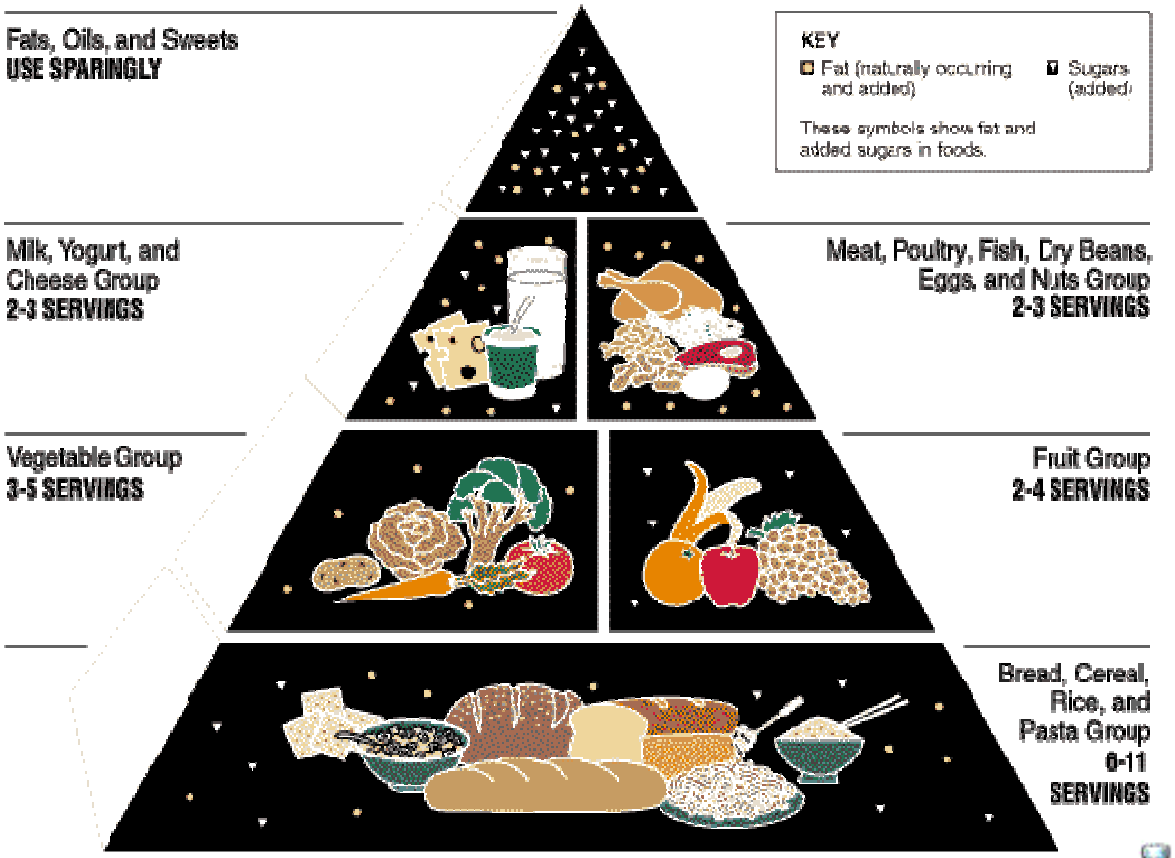


<=USA 1990 Pyramid "classical“

Pyramid => mediterranean

China 1997-2007

Anatomy of MyPyramid

USA 2000

One size doesn't fit all

USDA's new MyPyramid symbolizes a personalized approach to healthy eating and physical activity. The symbol has been designed to be simple. It has been developed to remind consumers to make healthy food choices and to be active every day. The different parts of the symbol are described below.

Activity

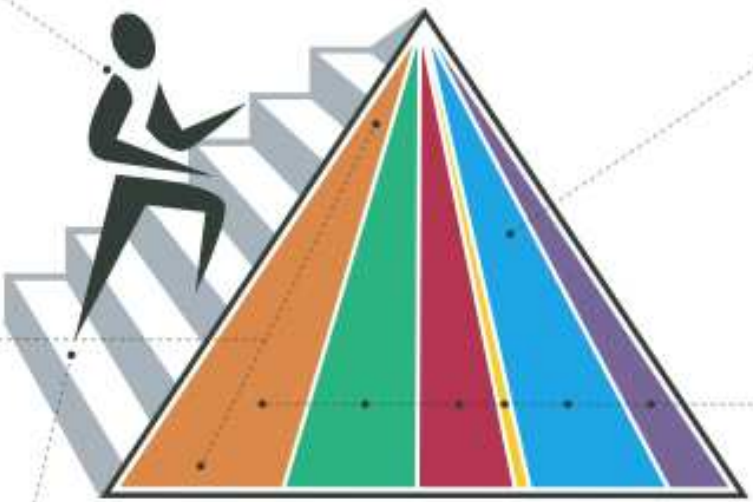
Activity is represented by the steps and the person climbing them, as a reminder of the importance of daily physical activity.

Moderation

Moderation is represented by the narrowing of each food group from bottom to top. The wider base stands for foods with little or no solid fats or added sugars. These should be selected more often. The narrower top area stands for foods containing more added sugars and solid fats. The more active you are, the more of these foods can fit into your diet.

Personalization

Personalization is shown by the person on the steps, the slogan, and the URL. Find the kinds and amounts of food to eat each day at MyPyramid.gov.



MyPyramid.gov

STEPS TO A HEALTHIER YOU

Proportionality

Proportionality is shown by the different widths of the food group bands. The widths suggest how much food a person should choose from each group. The widths are just a general guide, not exact proportions. Check the Web site for how much is right for you.

Variety

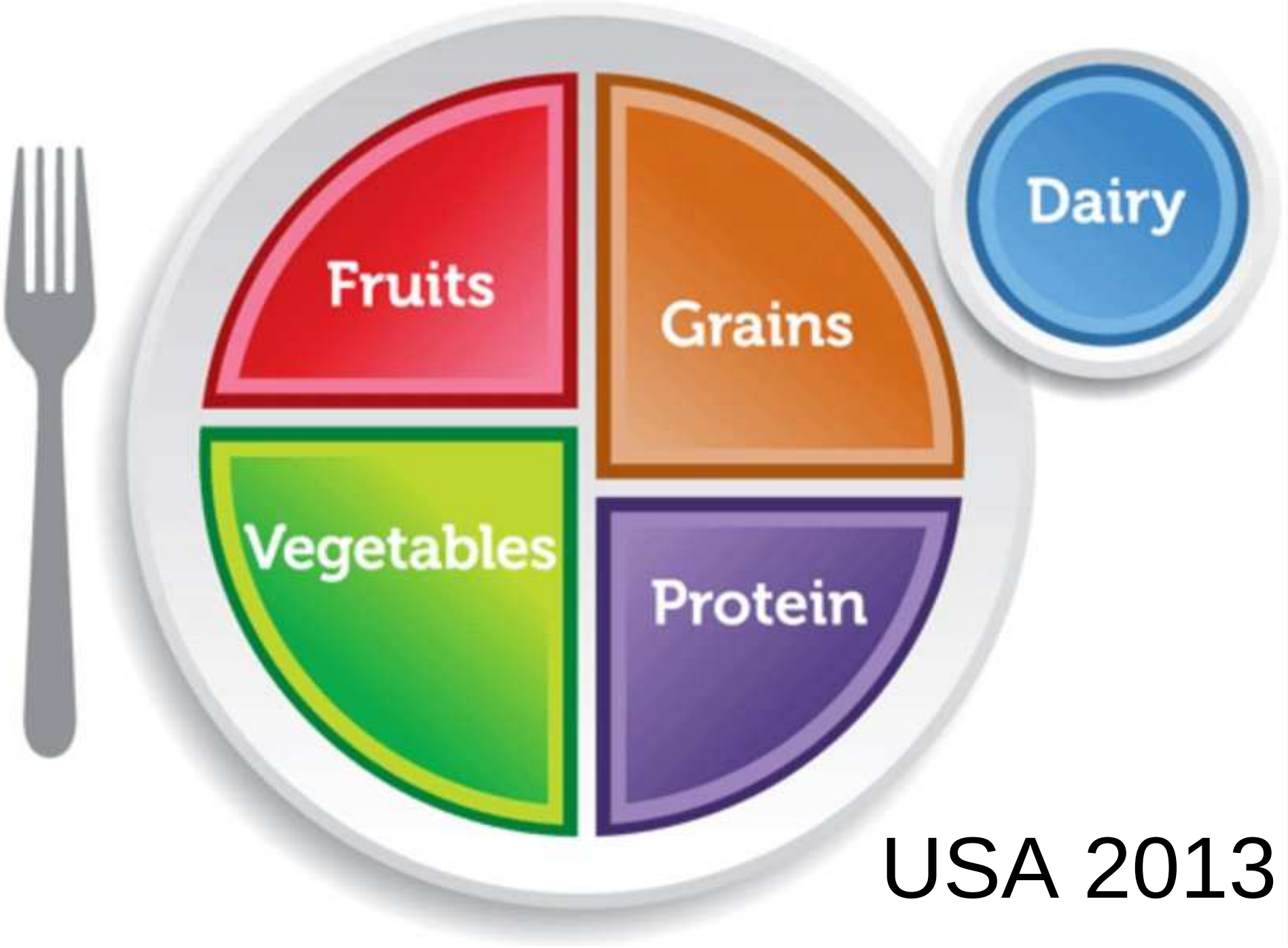
Variety is symbolized by the 6 color bands representing the 5 food groups of the Pyramid and oils. This illustrates that foods from all groups are needed each day for good health.

Gradual Improvement

Gradual improvement is encouraged by the slogan. It suggests that individuals can benefit from taking small steps to improve their diet and lifestyle each day.

USDA U.S. Department of Agriculture
Center for Nutrition Policy and Promotion
April 2005 CNPP-16

GRAINS | VEGETABLES | FRUITS | OILS | MILK | MEAT & BEANS

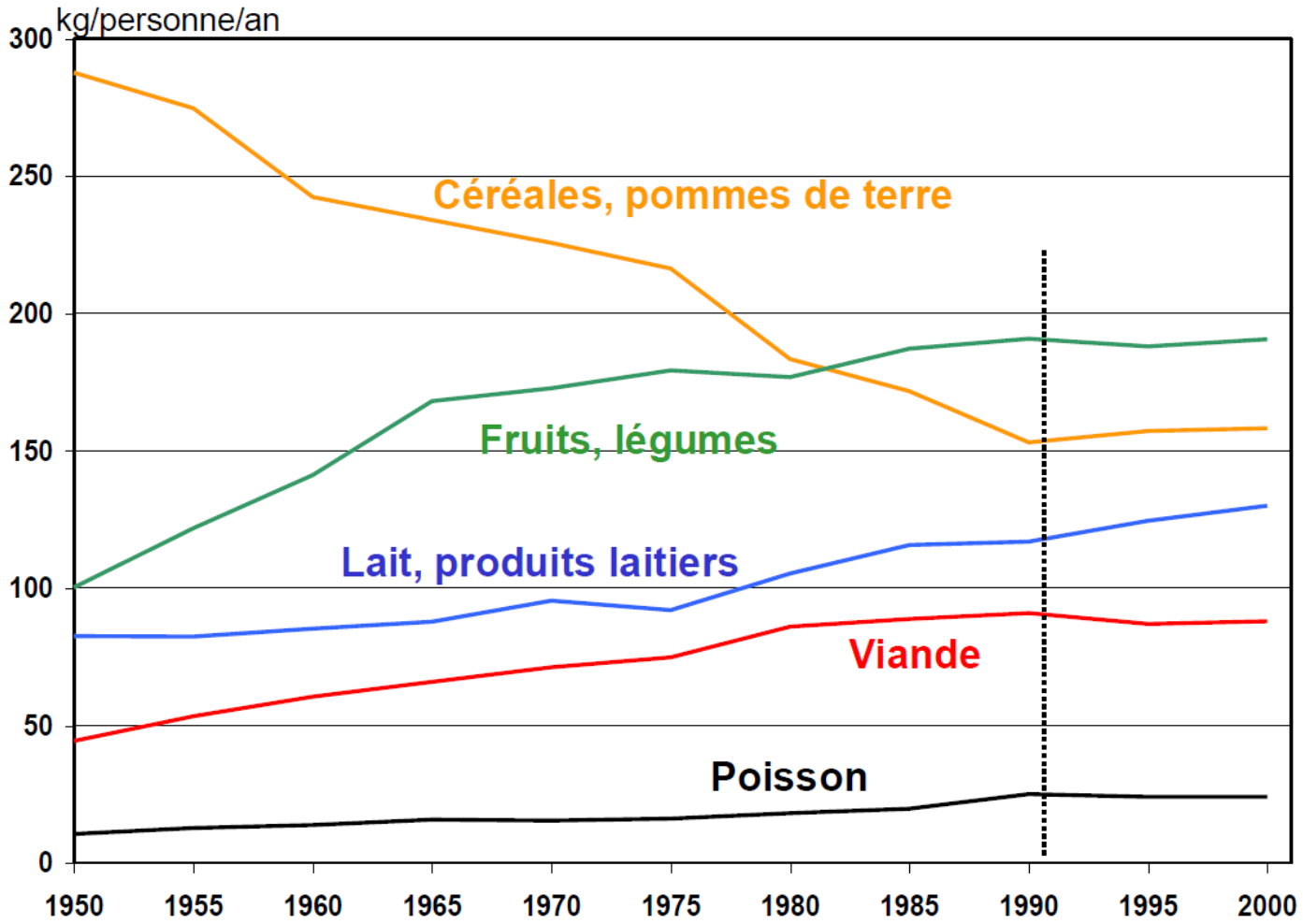


USA 2013

It is Smarter
Knowing your Target

- Instead giving precise advices on all nutrients
- Concentrate message on useful changes, on "bad" behaviors
- Message should not be the same in each country, not the same for everybody
- E.g., French PNNS

Intake of Major Foods in France 1950-2000



Source : INSEE Annuaire

Institut National de la Recherche Agronomique

ECOLE NATIONALE VETERINAIRE TOULOUSE

French **PNNS,** Programme National Nutrition Santé

- **1 - Increase fruits & vegetables**
- **2 – Increase calcium intake**
- **3 - Reduce fat intake**
- **4 – Increase carbohydrates**
- **5 – Reduce alcohol intake** conclusion
- *6 - Reduce blood cholesterol*
- *7 - Reduce blood pressure*
- *8 - Reduce obesity*
- **9 – Increase physical activity**

Denis E. Corpet

SAIN,LIM
Nutrient Profiling System

- Nicole **Darmon** et al., Am. J. Clin. Nutr. 2009

  EFSA food profile for health claims EC regulation no 1924/2006

- **SAIN is "good": a high SAIN score** is wanted since it means lots of good nutrients vs. Calories

- **LIM is "bad": a low LIM score** is wanted since it means less "bad" nutrients (already too much)

SAIN,LIM
Nutrient Profiling System

SAIN score (calculated for 100 kCal of food)

How can each food provide five basic positive nutrients?

- Protein 65g
- Fiber 25g
- Vitamin C 110mg
- Calcium 900mg
- Iron 12.5 mg

$$\mathrm{SAIN}_i = \frac{\sum_{p=1}^{p=5} \mathrm{ratio}_{ip}}{5} \times 100$$

$$\mathrm{ratio}_{ip} = \left[\frac{\mathrm{nutrient}_{ip}}{RVp}\right] \times \frac{100}{Ei}$$

nutrient *ip* is the quantity (g, mg, or µg) of positive nutrient *p* in 100 g of food *i*, *RVp* is the daily recommended value for nutrient *p*, and *Ei* is the energy content of 100 g of food *i* (in kcal/100 g).

SAIN,LIM
Nutrient Profiling System

LIM score: (calculated for 100 g of food)

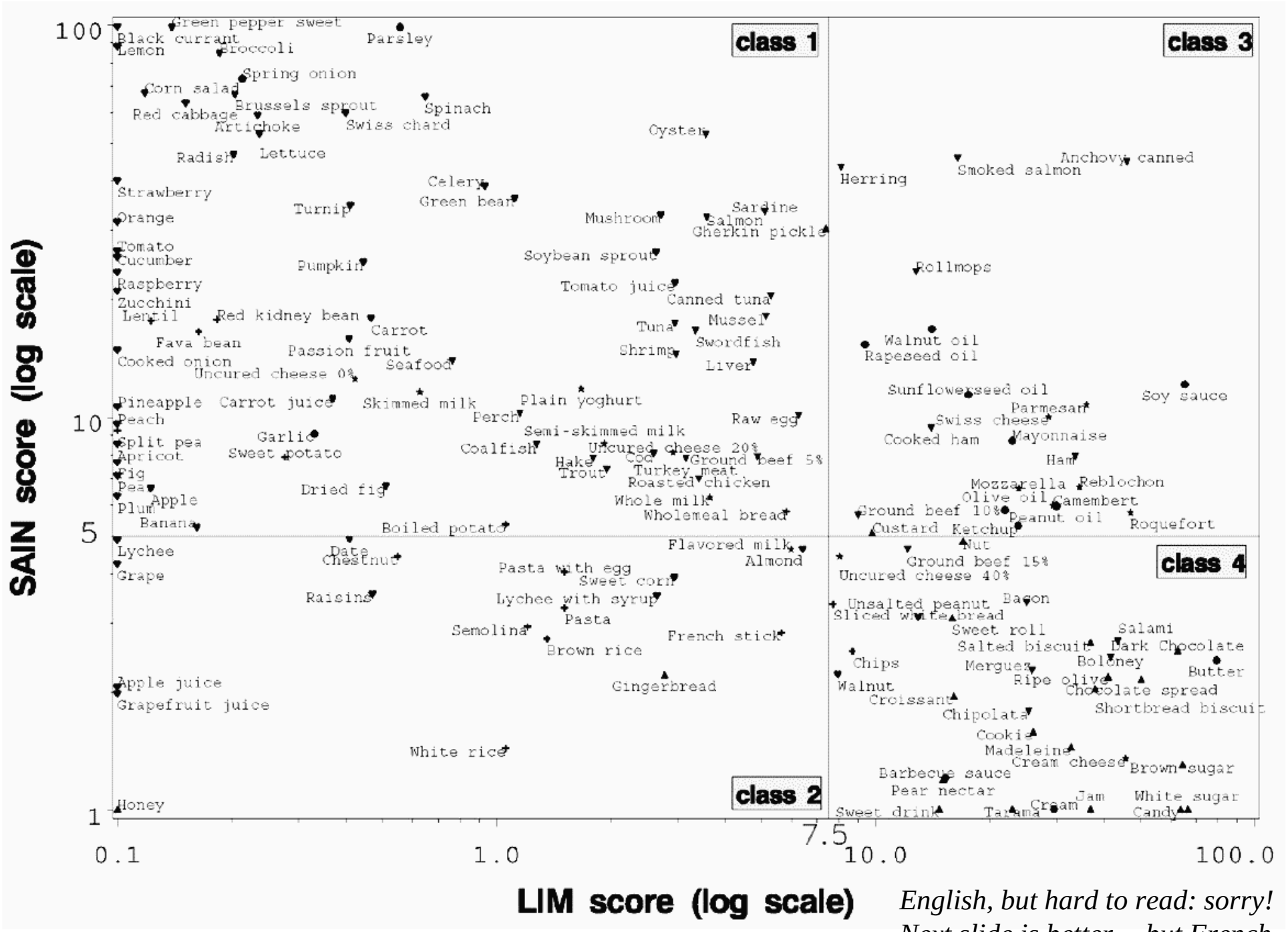
How can each food provide excess of negative nutrients?

- Saturated Fatty Acids 22g
- Added Sugars 50g
- Sodium 3g (= 8g salt)

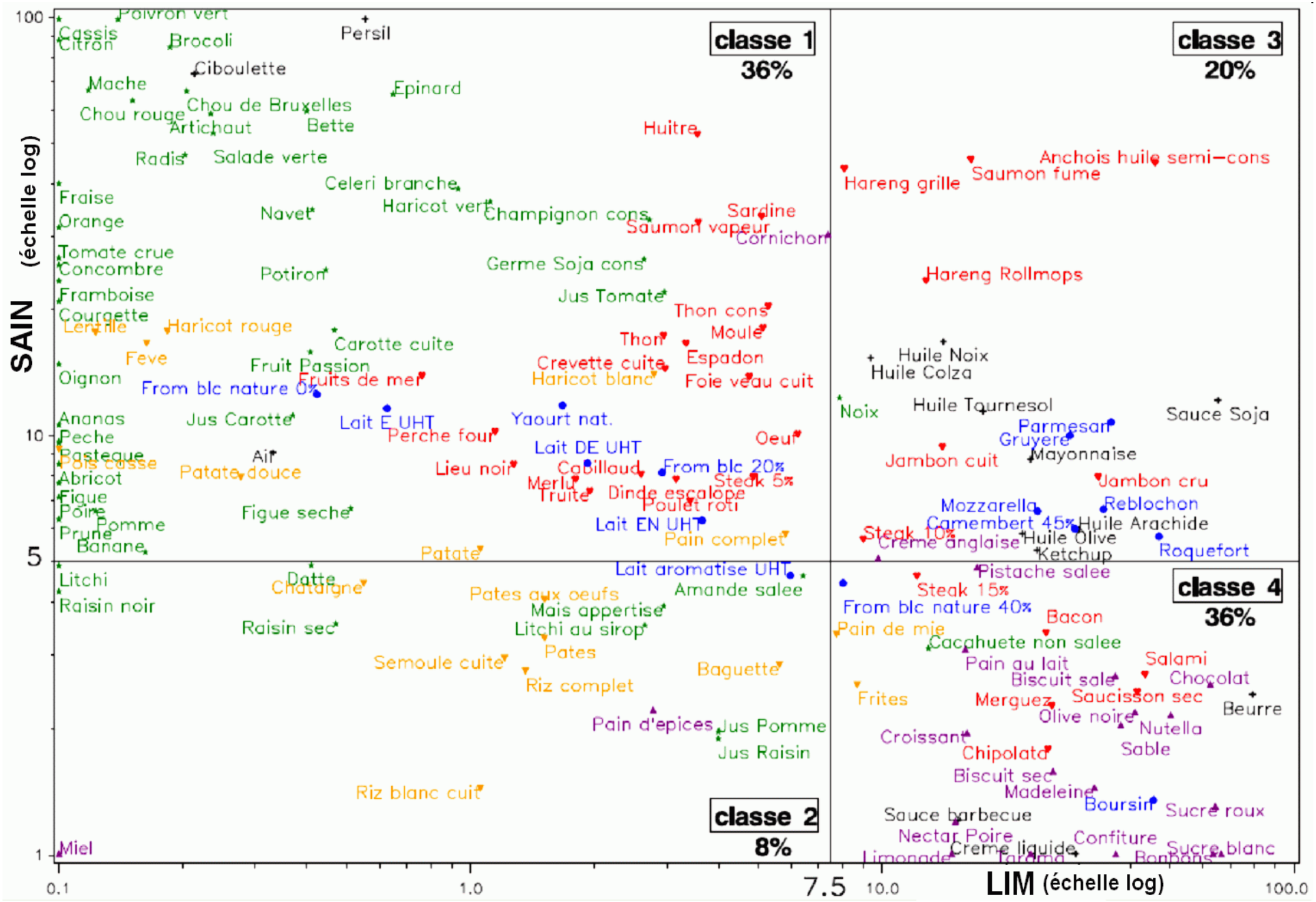
$$\mathrm{LIM}_i = \frac{\sum_{l=1}^{l=3} \mathrm{ratio}_{il}}{3}$$

$$\mathrm{ratio}_{il} = \left[\frac{\mathrm{nutrient}_{il}}{\mathrm{MRV}_l}\right] \times 100$$

where nutrient *il* is the content (g, mg) of limited nutrient *l* in 100g of food *i*, and *MRVl* is the daily maximal recommended value for nutrient *l*.



English, but hard to read: sorry!
Next slide is better… but French


classe 1
36%
classe 3
20%
classe 2
8%
classe 4
36%
SAIN (échelle log)
LIM (échelle log)
100
10
5
1
0.1
1.0
7.5
10.0
100.0
Poivron vert
Cassis
Citron
Brocoli
Persil
Ciboulette
Mache
Epinard
Chou de Bruxelles
Chou rouge
Artichaut
Bette
Huitre
Radis
Salade verte
Anchois huile semi-cons
Saumon fume
Hareng grille
Celeri branche
Fraise
Haricot vert
Navet
Champignon cons
Sardine
Orange
Saumon vapeur
Cornichon
Tomate crue
Concombre
Germe Soja cons
Potiron
Hareng Rollmops
Framboise
Jus Tomate
Courgette
Thon cons
Lentille
Haricot rouge
Moule
Thon
Carotte cuite
Huile Noix
Feve
Crevette cuite
Espadon
Fruit Passion
Huile Colza
Oignon
Haricot blanc
Foie veau cuit
Fruits de mer
From blc nature 0%
Noix
Huile Tournesol
Sauce Soja
Ananas
Jus Carotte
Lait E UHT
Yaourt nat.
Parmesan
Peche
Perche four
Oeuf
Gruyere
Lait DE UHT
Jambon cuit
Mayonnaise
Pasteque
Air
Pois casse
Lieu noir
Cabillaud
From blc 20%
Patate douce
Jambon cru
Abricot
Merlu
Steak 5%
Figue
Truite
Dinde escalope
Reblochon
Poire
Figue seche
Poulet roti
Mozzarella
Pomme
Camembert 45%
Huile Arachide
Prune
Lait EN UHT
Steak 10%
Pain complet
Huile Olive
Banane
Creme anglaise
Roquefort
Patate
Ketchup
Lait aromatise UHT
Pistache salee
Litchi
Datte
Amande salee
Steak 15%
Chataigne
Pates aux oeufs
From blc nature 40%
Raisin noir
Mais appertise
Bacon
Litchi au sirop
Pain de mie
Raisin sec
Pates
Cacahuete non salee
Salami
Pain au lait
Semoule cuite
Baguette
Biscuit sale
Chocolat
Riz complet
Frites
Merguez
Saucisson sec
Beurre
Olive noire
Pain d'epices
Jus Pomme
Nutella
Croissant
Jus Raisin
Sable
Chipolata
Riz blanc cuit
Biscuit sec
Madeleine
Boursin
Sucre roux
Sauce barbecue
Miel
Nectar Poire
Confiture
Creme liquide
Sucre blanc
Limonade
Bonbons

Finally to conclude,
What is a Good Diet ?

- **Eat not too much** & **Move** : *Keep BMI [19-25]*
- **Balance:** Carbohydrates - Fat - Proteins
  % ***Calories***: *approx. Fat 30%, Prot. 15%, Carb. 55%*
- Choose good **Quality** carbohydrate, fat, protein
  - Low Glycemic Index starch, more Fiber (30 g/d)
  - Fats SFA<1/3, PUFA: n-3/n-6 ratio ¼, DHA+EPA 0.5g/d
- **Diversify** foods (micronutrients, phytochemicals)
- Increase **fruits & vegetables** (400-800g/d)


mangez
Sain et Sympa !

Bon appétit !

Conference is online
http://Corpet.net/Denis/

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