OBESITY AND FOOD IN EUROPE,
THE POLICY CHALLENGE

Fattened by fat: a fact… or only a hypothesis

Dr Didier Chapelot

Maître de Conférences de l'Université Paris 13

Physiologie du Comportement Alimentaire

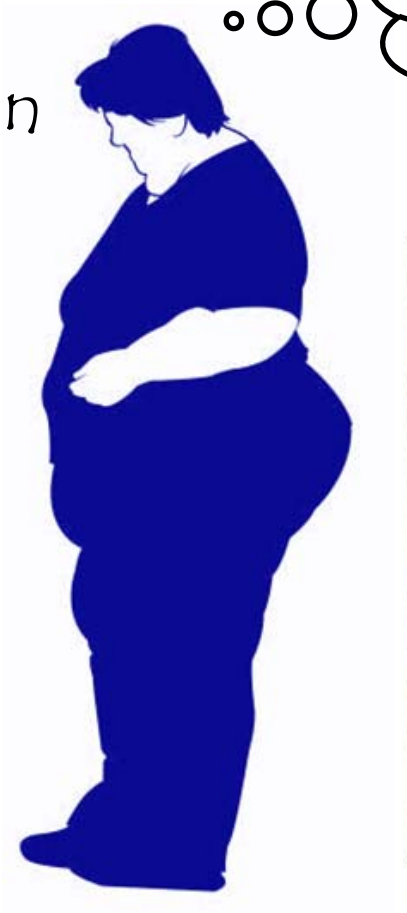
Laboratoire des Réponses Cellulaires et Fonctionnelles à l'Hypoxie EA 2363

dchapelot@gmail.com

OBESITY AND FOOD IN EUROPE,
THE POLICY CHALLENGE

According to the "principle of incorporation"

1. We are what we eat
2. We are fat
3. We must have eaten too much fat



OBESITY AND FOOD IN EUROPE,
THE POLICY CHALLENGE

General agreement:

1. Dietary fats are the main determinants of our body fat stores
2. The growing prevalence of obesity is mainly caused by the excessive consumption of fats

Problems:

1. Experimentally and physiologically, this role of fats is challenged
2. A closer look to epidemiological studies raises concern
3. Confounding factors may lower the role of dietary fats to non or low significance in obesity prevalence

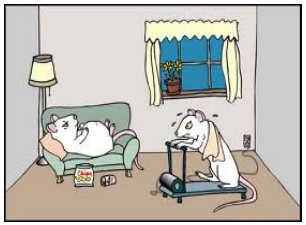
OBESITY AND FOOD IN EUROPE,
THE POLICY CHALLENGE

1. **Do experimental animals fatten because of fat?**
2. **Some facts about the relation between dietary fats and eating behaviour.**
3. **Do epidemiological studies demonstrate that dietary fats make us fat?**
4. **Fiber, exercise, genetics: the modulating factors.**
5. **A fa(s)t conclusion.**

OBESITY AND FOOD IN EUROPE,
THE POLICY CHALLENGE

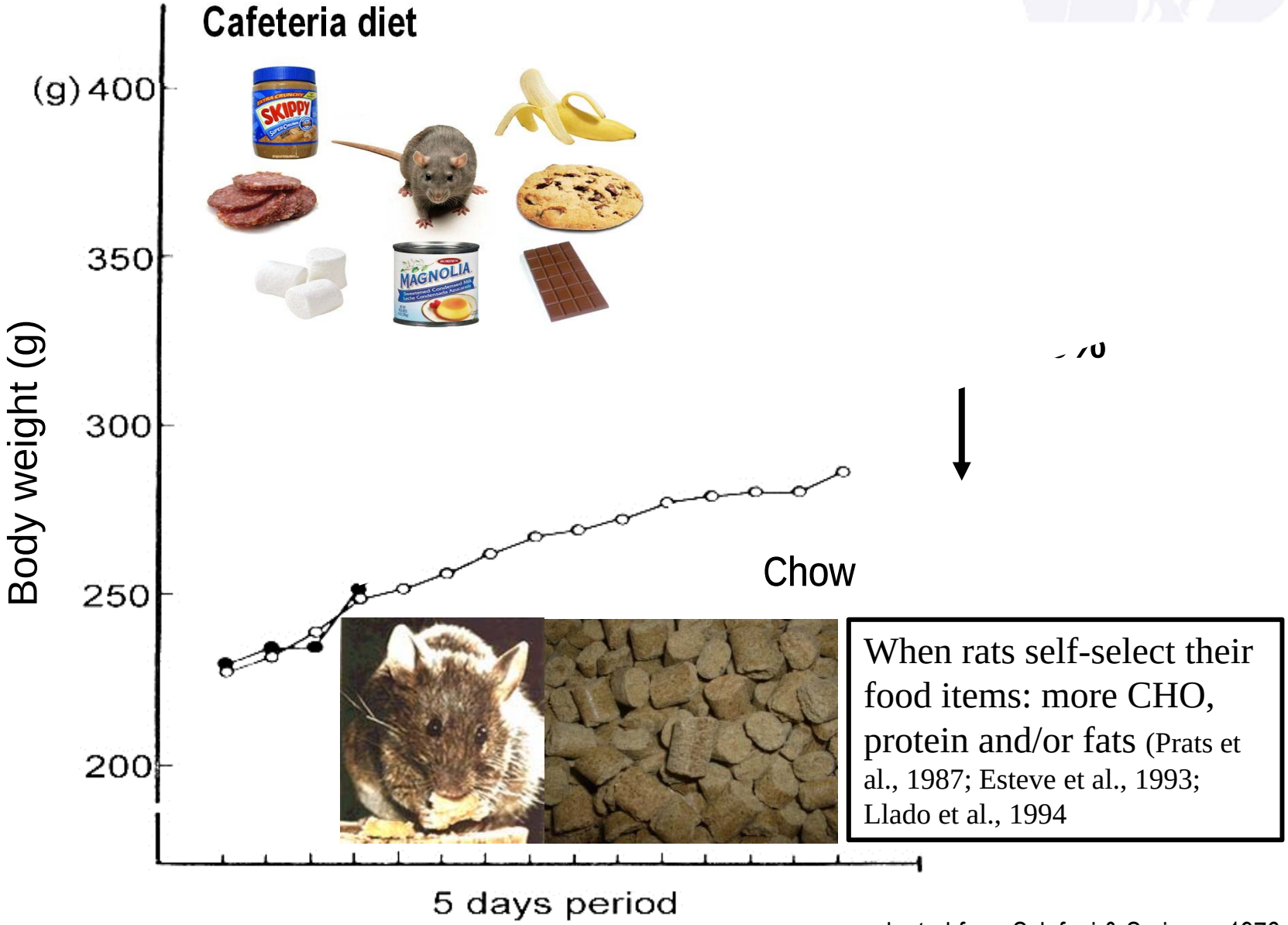
1. **Do experimental animals fatten because of fat?**
2. Some facts about the relation between dietary fats and eating behaviour.
3. Do epidemiological studies demonstrate that dietary fats make us fat?
4. Fiber, exercise, genetics: the modulating factors.
5. A fa(s)t conclusion.

Energy intake is the efferent pathway of energy homeostasis
Weight is the “apparently regulated” variable



Mayer & Thomas, 1967

Do experimental animals fatten because of fat?

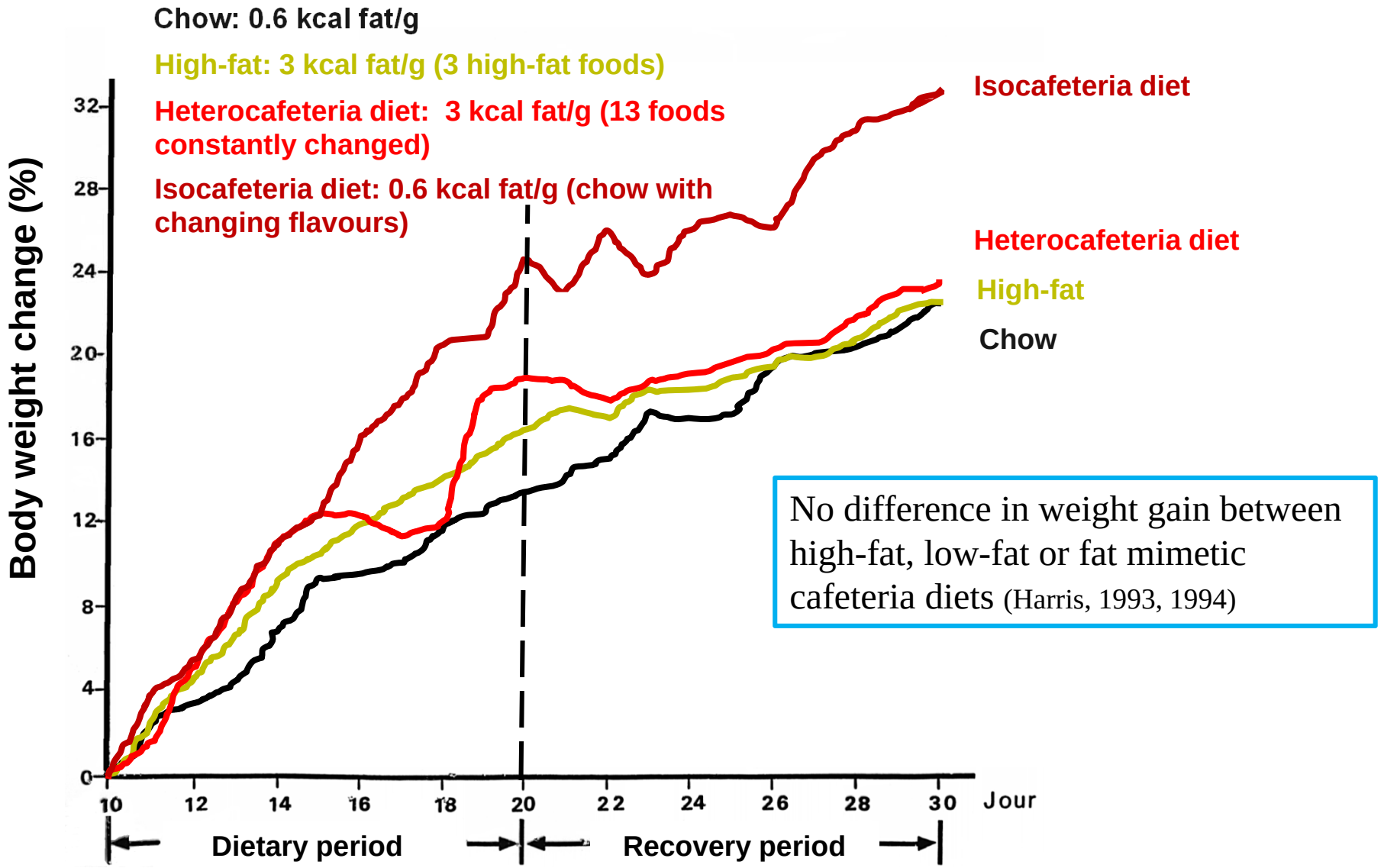


When rats self-select their food items: more CHO, protein and/or fats (Prats et al., 1987; Esteve et al., 1993; Llado et al., 1994

adapted from Sclafani & Springer, 1976

Do experimental animals fatten because of fat?

OBESITY AND FOOD IN EUROPE, THE POLICY CHALLENGE



No difference in weight gain between high-fat, low-fat or fat mimetic cafeteria diets (Harris, 1993, 1994)

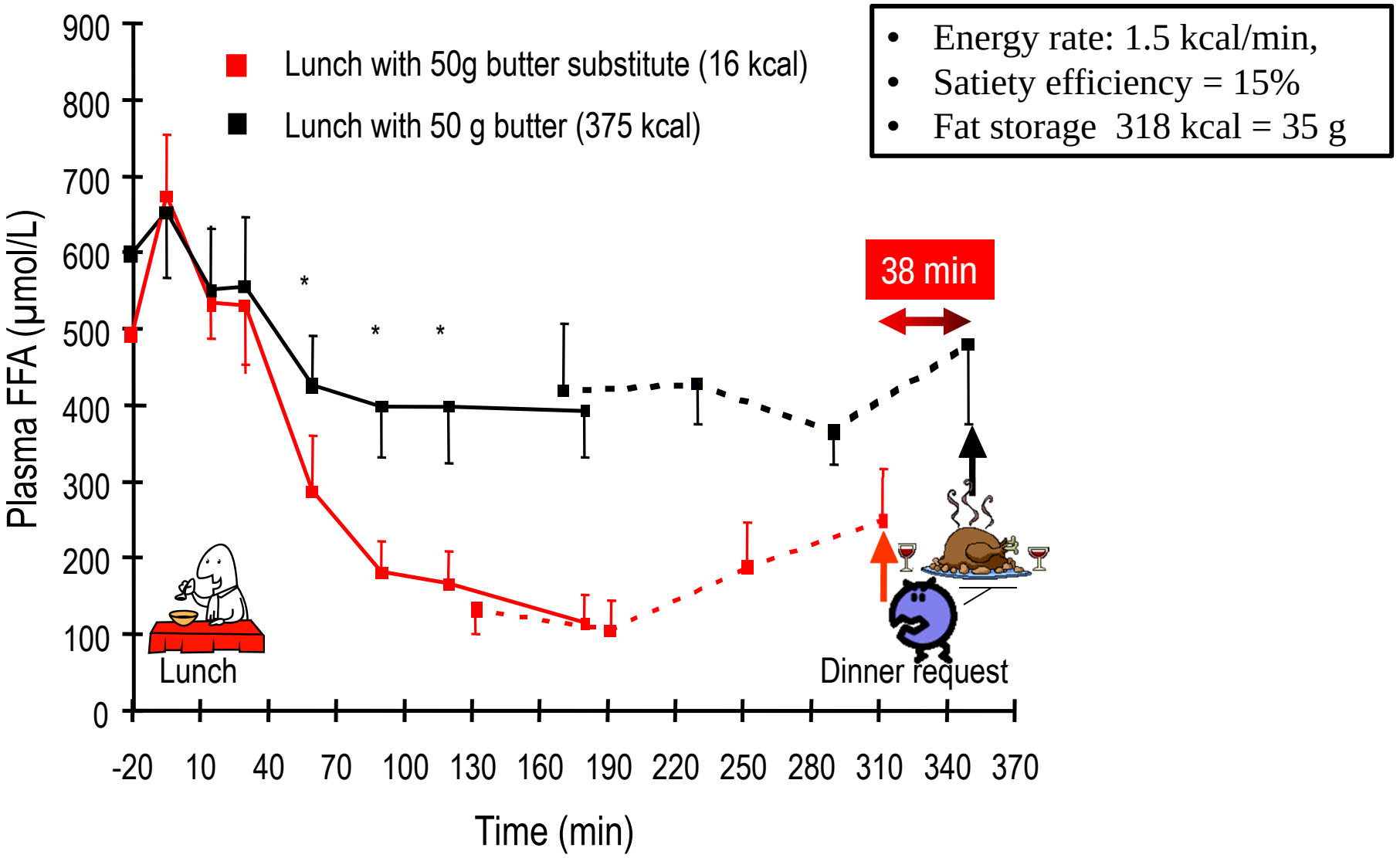
Adapted from Louis-Sylvestre et al., 1984


Fats are
not a
necessary
component
of
fattening
diets
in
laboratory
animals

OBESITY AND FOOD IN EUROPE,
THE POLICY CHALLENGE

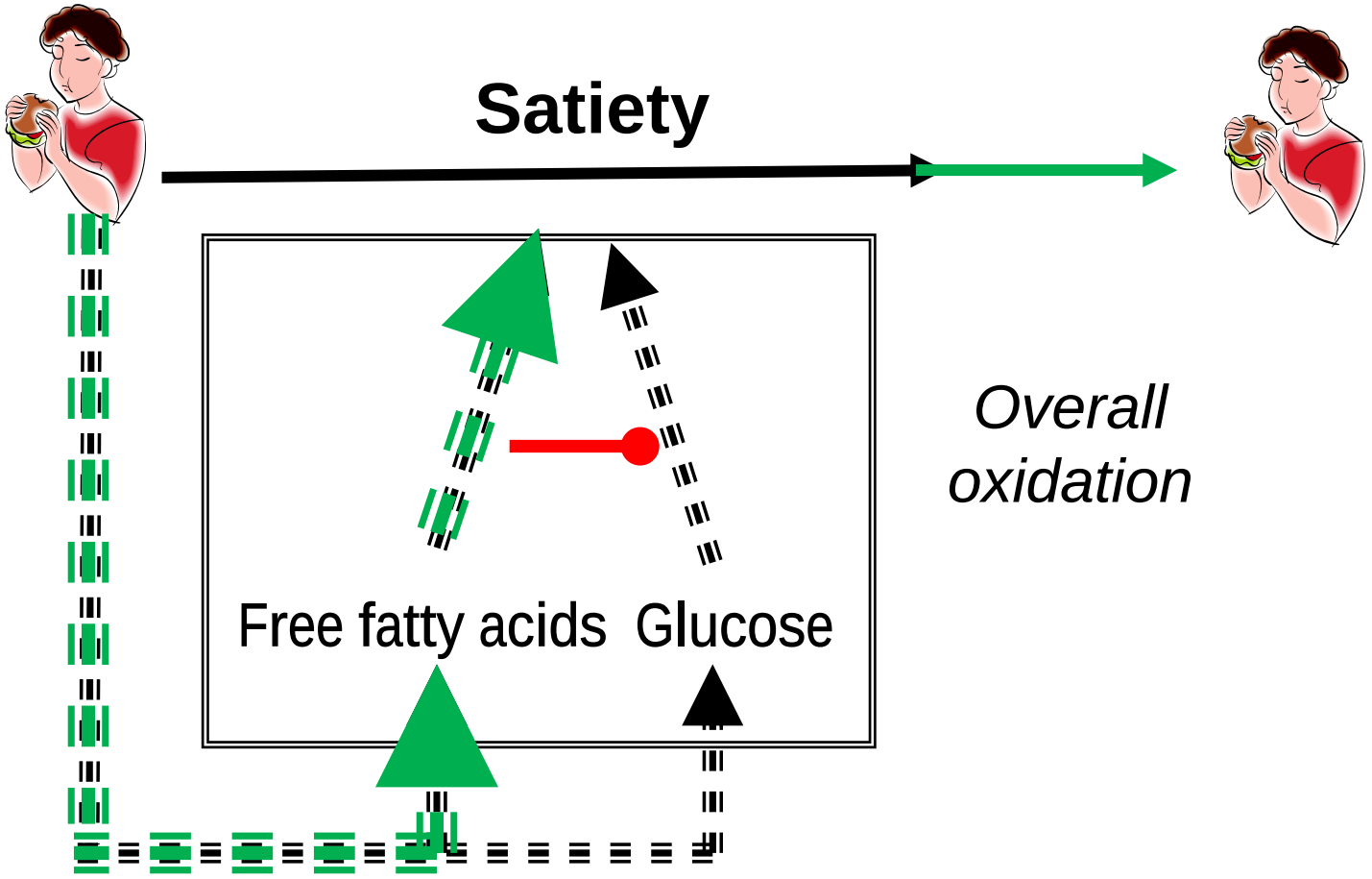
1. Do experimental animals fatten because of fat?
2. **Some facts about the relation between dietary fats and eating behaviour.**
3. Do epidemiological studies demonstrate that dietary fats make us fat?
4. Fiber, exercise, genetics: the modulating factors.
5. A fa(s)t conclusion.

Some facts about the relation between dietary fats and eating behaviour



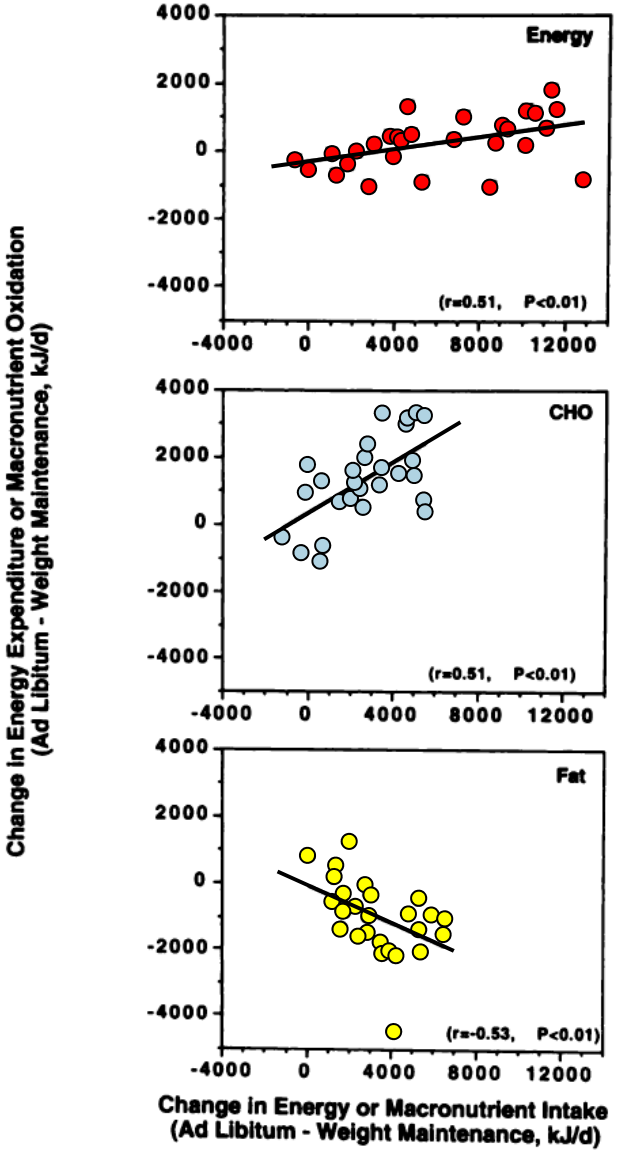
Adapted from Himaya et al., 1997

Some facts about the relation between dietary fat and eating behaviour



Adapted from Chapelot, Exp Biol., 2009

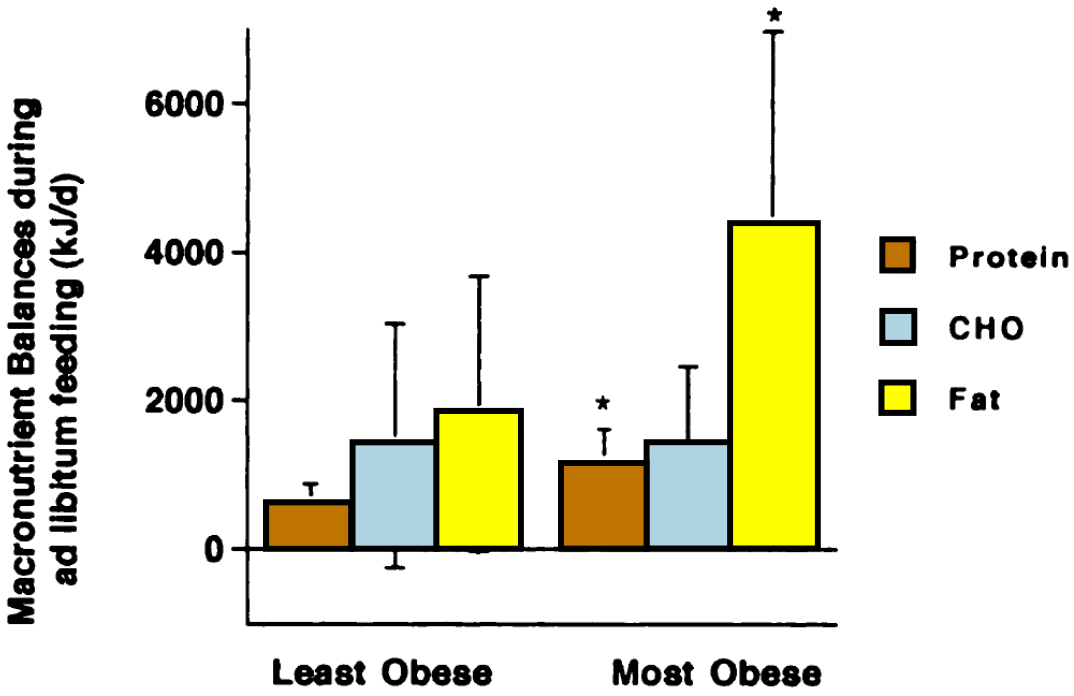
Some facts about the relation between dietary fats and eating behaviour



28 obese Pima women freely selecting their foods during 5 days

Contrary to CHO, inverse correlation between fat intake and fat oxidation

Increased fat intake in the most obese



Larson et al., 1995


Dietary fats contribute to satiety but their satiety
efficiency and their oxidative / storage ratio are weak

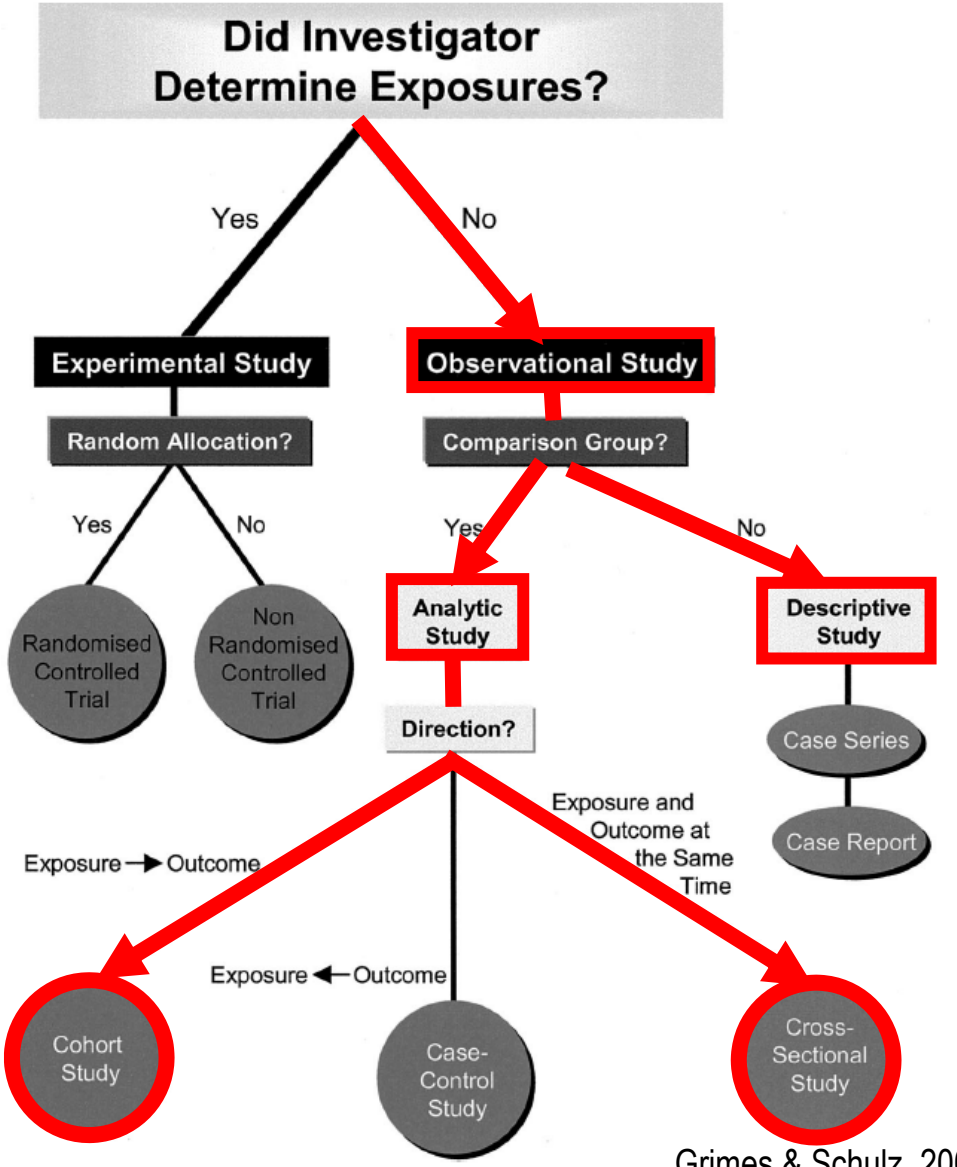
OBESITY AND FOOD IN EUROPE,
THE POLICY CHALLENGE

1. Do experimental animals fatten because of fat?
2. Some facts about the relation between dietary fats and eating behaviour.
3. **Do epidemiological studies demonstrate that dietary fats make us fat?**
4. Fiber, exercise, genetics: the modulating factors.
5. A fa(s)t conclusion.

Do epidemiological studies demonstrate that dietary fats make us fat?

Epidemiological studies in the domain of the causal factors of obesity:

- **Observational**
- **Descriptive**: no comparison group
- **Analytic**: by extension
  - **Single cohort**: fat intake (exposure) and obesity (outcome)
  - **Cross-sectional**: dietary fats and obesity at the same time



Grimes & Schulz, 2002

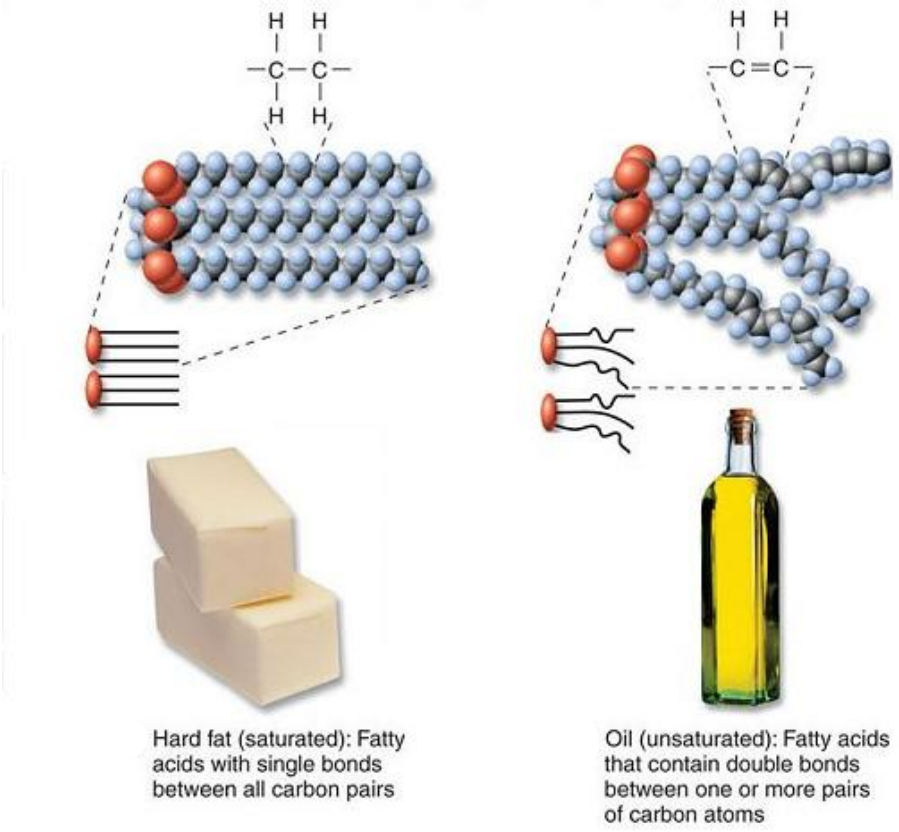
Do epidemiological studies demonstrate that dietary fats make us fat?

Authors (yr)	Population	Correlation between dietary fat & BMI (or adiposity when available)
Kromhout et al. (1983)	805	r = 0.20
Dreon et al. (1988)	155	r = 0.20
Romieu et al. (1988)	141	r = 0.20
Tremblay et al. (1989)	244	r ~ 0.17
Miller et al. (1990)	109 107	r ~ 0.37
Tucker & Kano (1992)	205	r = 0.40
Ward et al. (1994)	878	r = 0.13
Mayer-Davis et al. (1997)	1173	r = 0.10
Doucet et al. (1998)	128	r ~ 0.20
Lovejoy et al. (2001)	97	r = 0.32
Satia-Abouta et al. (2002)	15 266	r = 0.35
Mirmiran et al. (2006)	725 565	r ~ 0.40
		Mean r ~ 0.27

Do epidemiological studies demonstrate that dietary fats make us fat?

Authors (yr)	Population	Following	Dietary fat intake significant predictor of BMI (or adiposity when available)
Colditz et al. (1990)	31 940	8 yrs	YES
Kant et al. (1995)	4 567 2580	10 ½ yrs	NO
Sherwood et al. (2000)	826 218	3 yrs	YES
Schulz et al. (2002)	17 369	2 yrs	YES
Koh-Banerjee et al. (2003)	16 587	9 yrs	YES
Field et al. (2007)	41 518	8 yrs	YES
Forouhi et al. (2009)	52 307 37 125	7 yrs	NO
Lin et al. (2011)	810	1 ½ yr	YES
		~ 6 yrs	**6 vs 2**

The case of saturated fatty acids (SFA)



Do epidemiological studies demonstrate that dietary fats make us fat?

Cross-sectional, USA, 141 women, aged 34 – 59 yrs

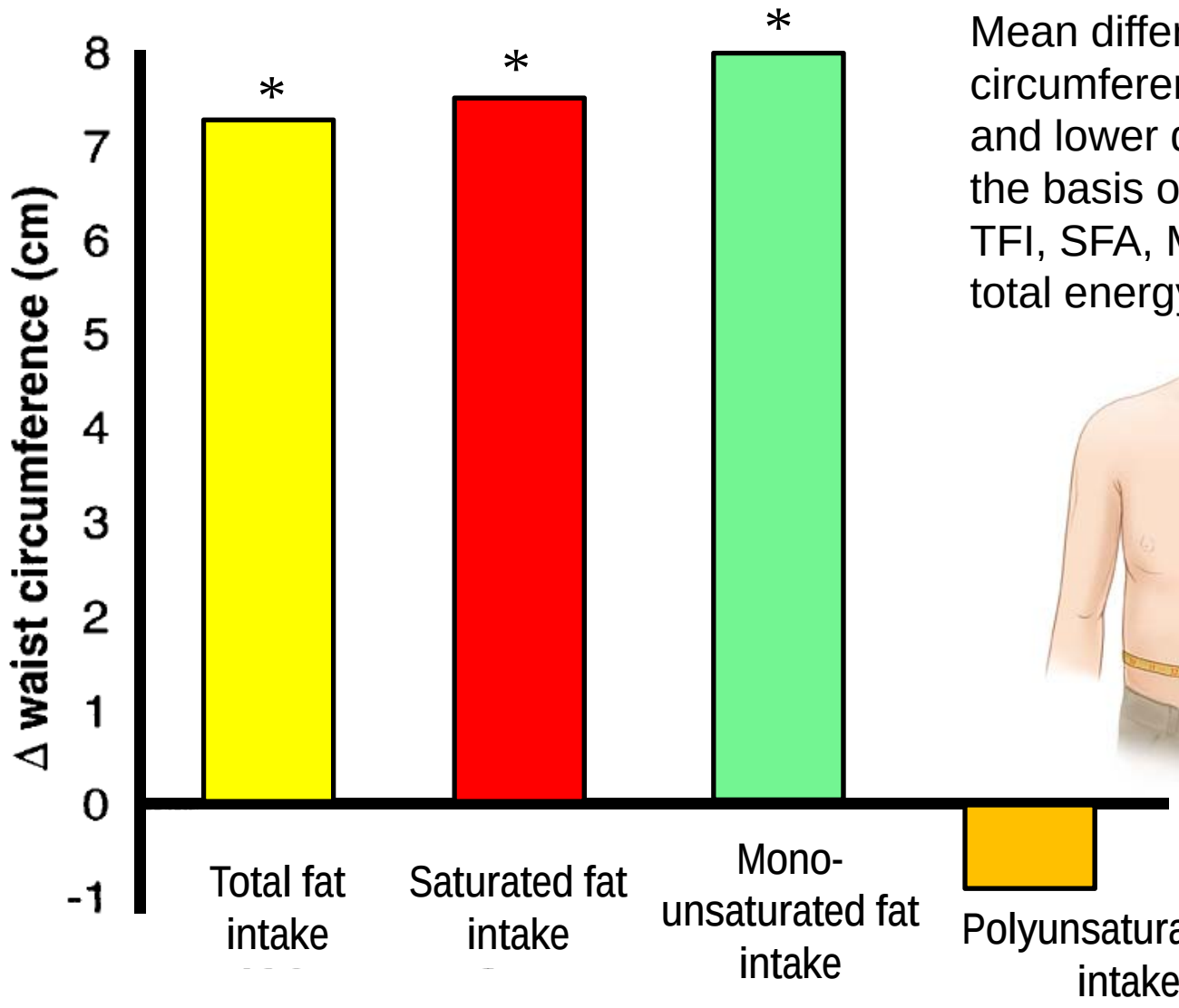
	Pearson correlation†	
Dietary variables*	*r*	*p*
g/d		
Total fatty acids	0.20	0.02
Saturated fatty acids	0.16	0.05
Polyunsaturated fatty acids	0.05	0.5
Carbohydrate	−0.12	0.2
Protein	0.10	0.3
Alcohol	−0.29	0.00

Partial correlation between BMI and macronutrients after adjustement for age and total energy intake

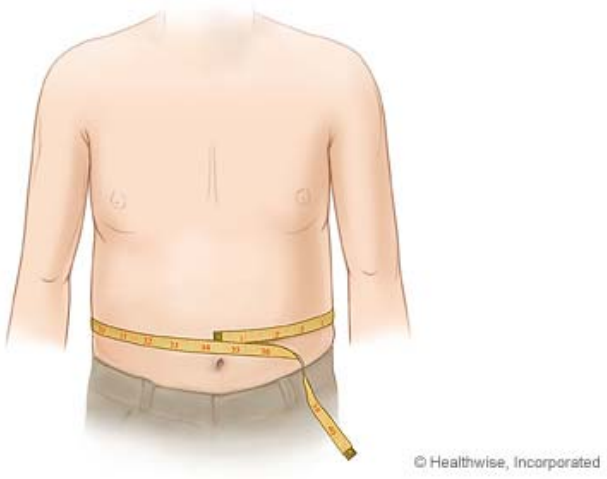
Romieu et al., 1988

Do epidemiological studies demonstrate that dietary fats make us fat?

Cross-sectional, Canada, 158 men, aged 55 ± 6 yrs



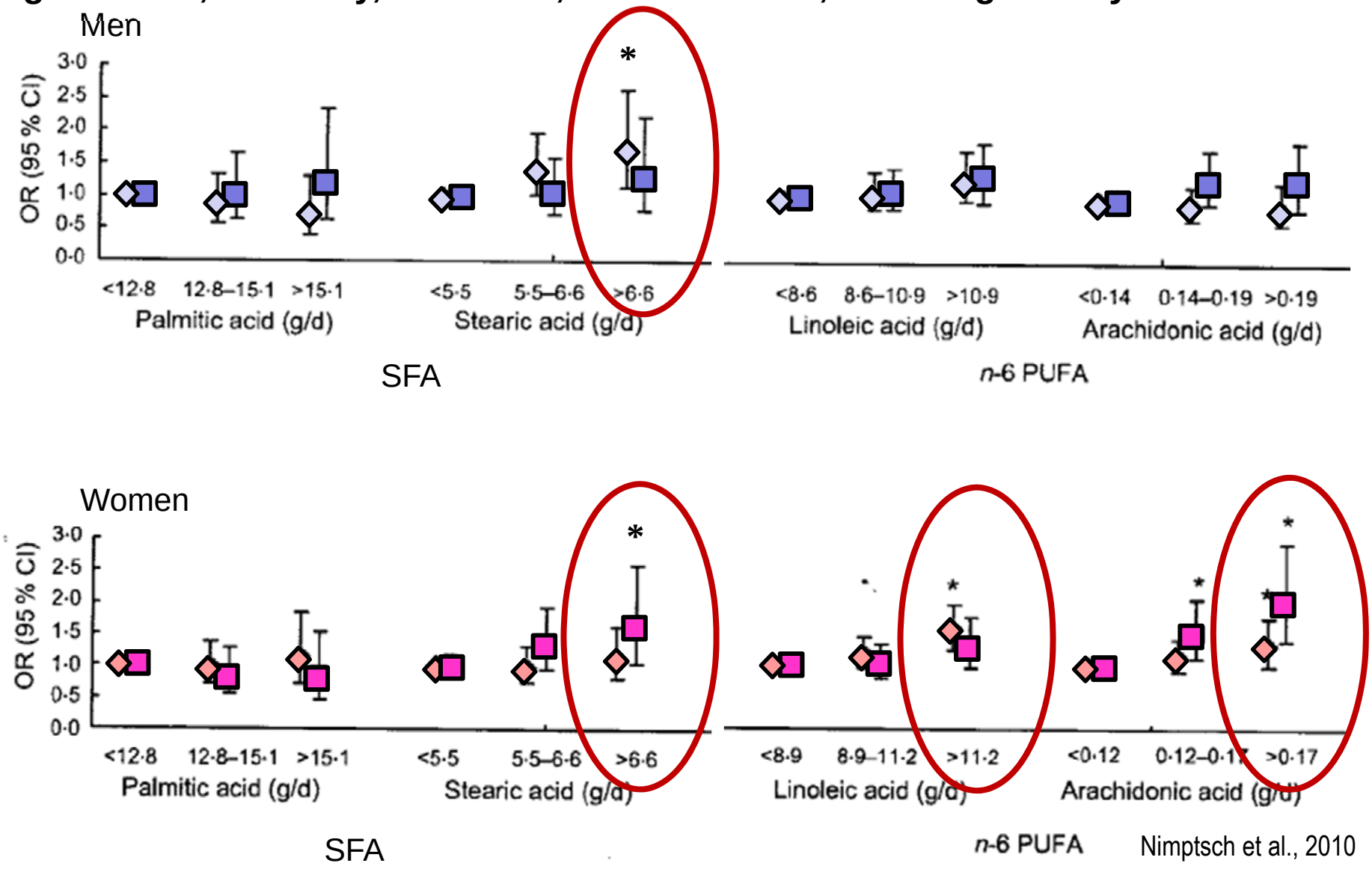
Mean difference in waist circumference between upper and lower quartiles divided on the basis of the contribution of TFI, SFA, MUFA and PUFA to total energy intake.



Doucet et al., 1998

Do epidemiological studies demonstrate that dietary fats make us fat?

Single-cohort, Germany, 9182 men, 10 867 women, following: ~ 6.5 yrs



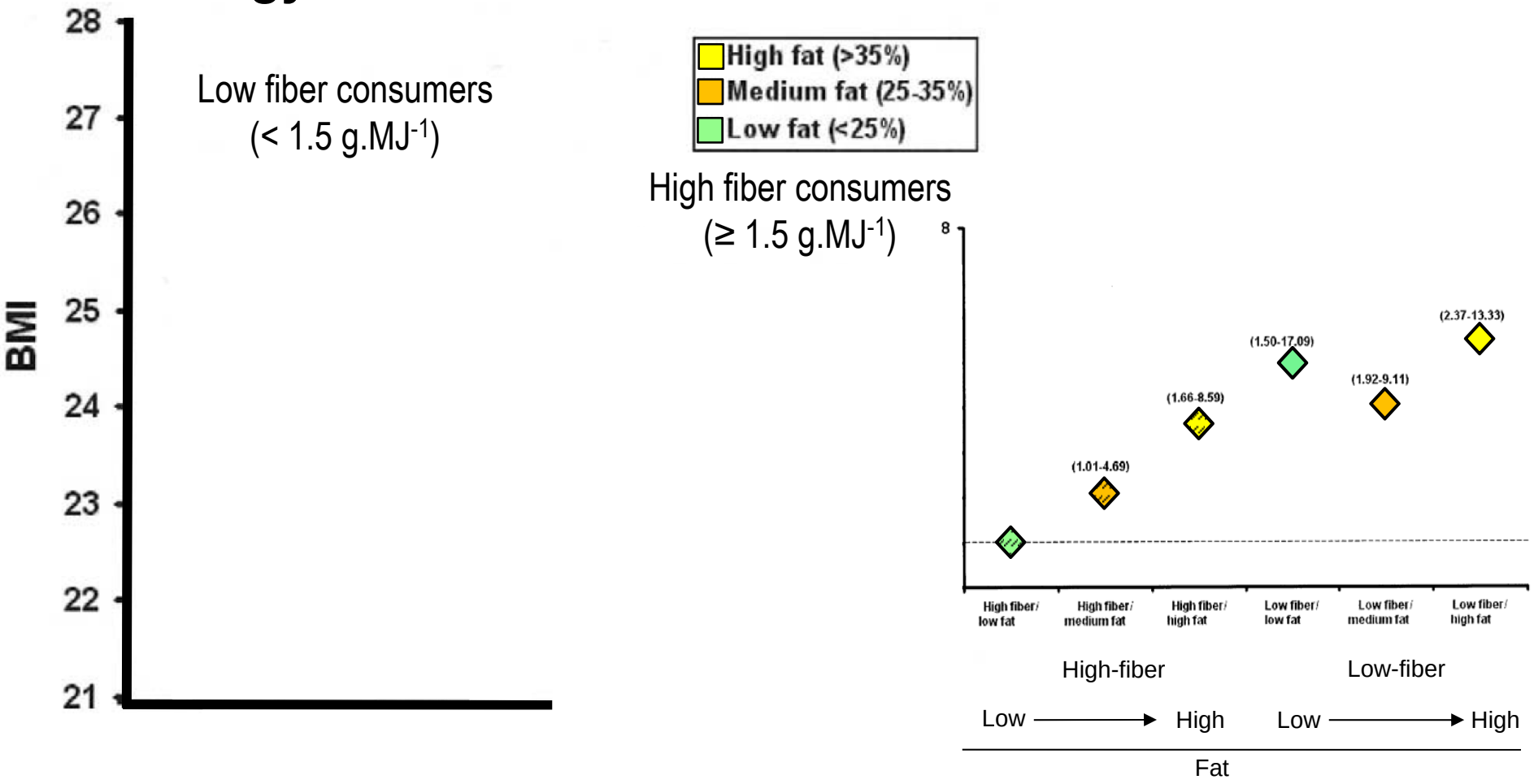
Nimptsch et al., 2010


Epidemiolo-
gical studies
show an
inconstant
and weak
relation
between
fats and
obesity,
some, like
SFA, being
more
specifically
concerned

OBESITY AND FOOD IN EUROPE,
THE POLICY CHALLENGE

1. Do experimental animals fatten because of fat?
2. Some facts about the relation between dietary fats and eating behaviour.
3. Do epidemiological studies demonstrate that dietary fats make us fat?
4. **Fiber, exercise, genetics: the modulating factors.**
5. A fa(s)t conclusion.

BMI in relation to intake of **fiber** and **percentage of energy from fat**



Howarth et al., 2005

Seven Countries Study (16 cohorts, 12 763 men between 1958 and 1964)

	UNIVARIATE MODEL		*MULTIVARIATE MODEL*	
Lifestyle variable	*β*	*95% CI*	*β*	*95% CI*
PAI **(physical activity index)**	−0.0071	−0.0088; −0.0054***	−0.0064	−0.0078; −0.0051***
Dietary fat (g/day)	−0.0047	−0.0505; 0.0599	−0.0052	−0.0135; 0.0238
Dietary fiber (g/day)	−0.2012	−0.3792; −0.0232*	−0.1267	−0.1984; −0.0551**

*P < 0.05, **P < 0.01, ***P < 0.001

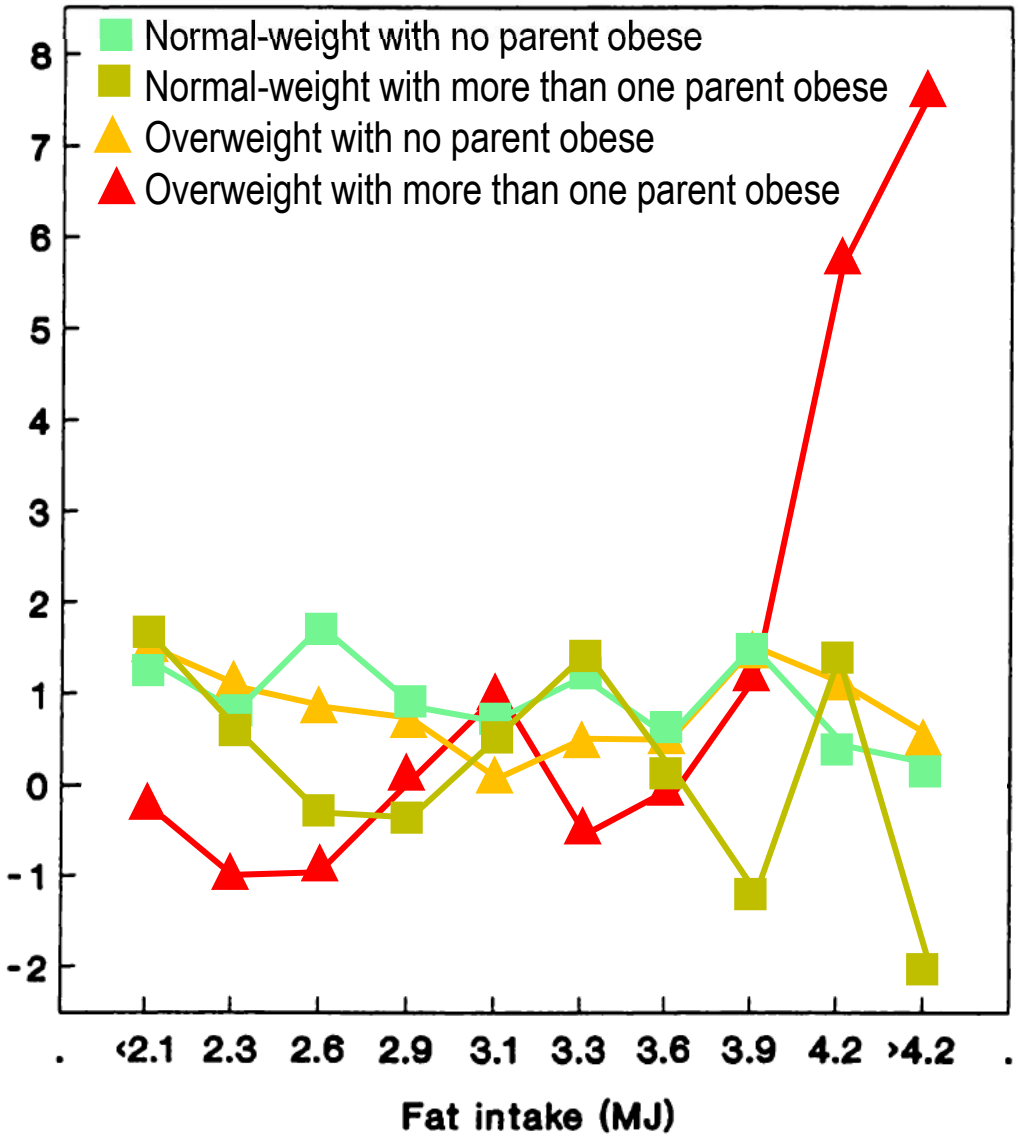
Kromhout et al., 2001

Brazilian Journal of Medical and Biological Research (2011) 44: 966-972
ISSN 0100-879X Review

Effect of high-fat diets on body composition, lipid metabolism and insulin sensitivity, and the role of exercise on these parameters

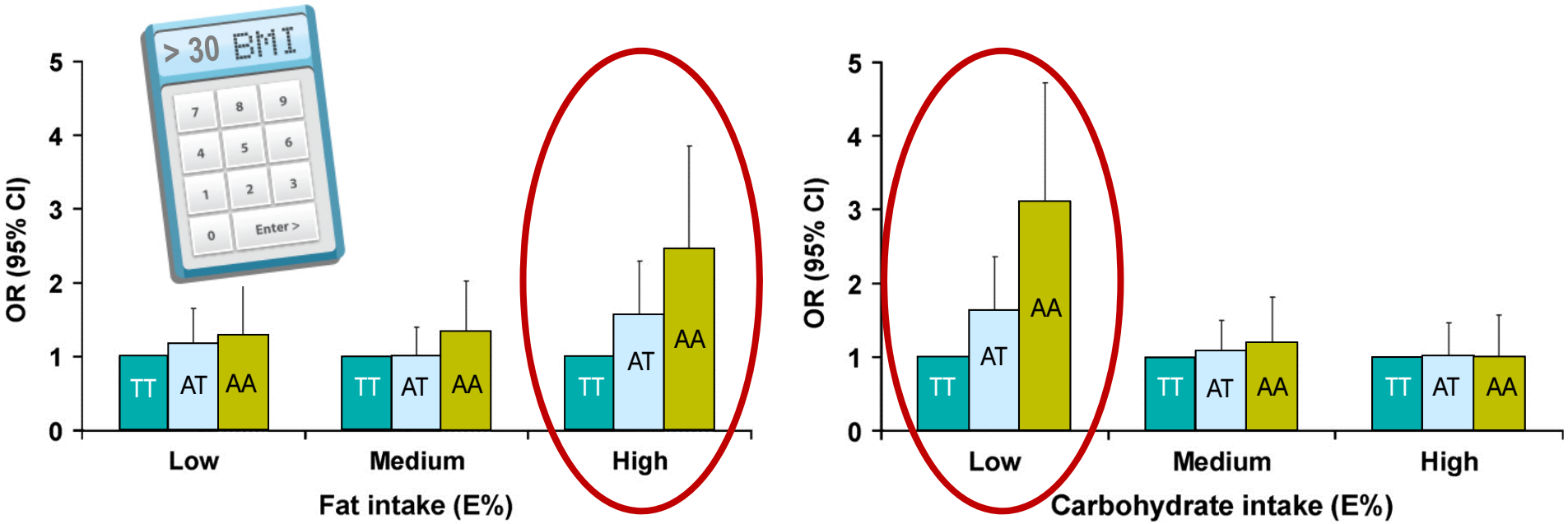
Coelho et al., 2011

361 women
6 yrs follow up



Heitmann et al., 1995

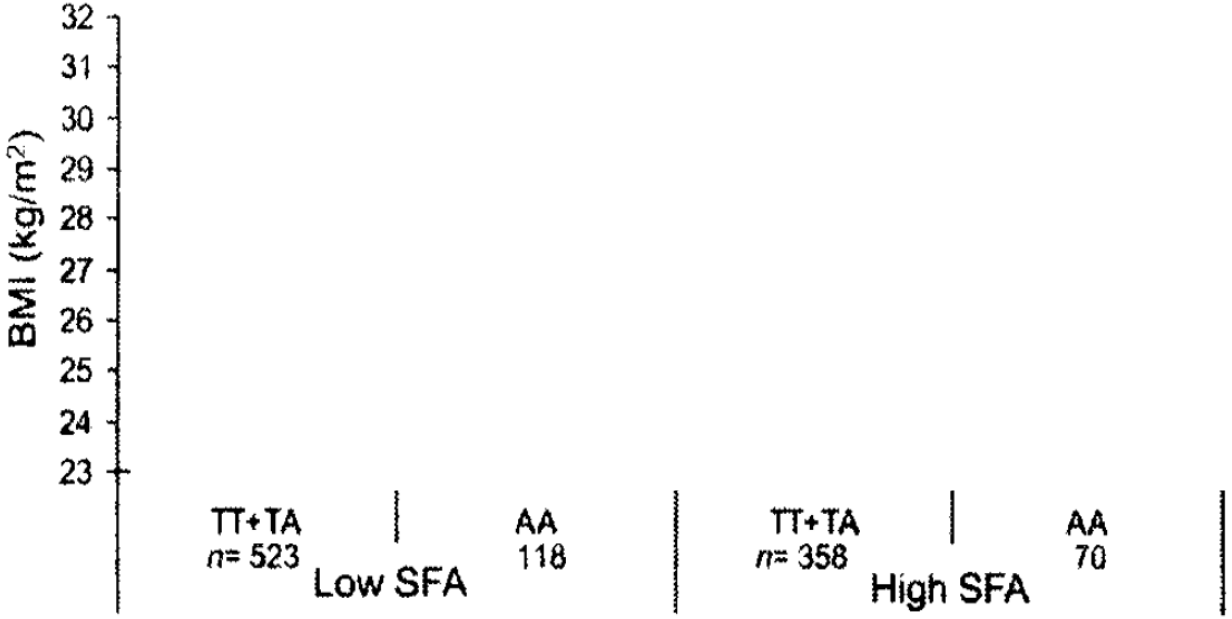
Three genes: **Fat mass and obesity-associated** (**FTO**), **Apolipoprotein A5** (**APOA5**) and **Peroxiredoxins** (**Prxs**)
Various single nucleotide polymorphisms (SNP) detected in the FTO gene: the **rs9939609 A allele** involved in obesity and food selection



Association between FTO genotype and obesity in strata of dietary intake categories (fat and carbohydrate intakes as a percentage of energy) in the Malmö Diet and Cancer–Cardiovascular cohort (4839 subjects).

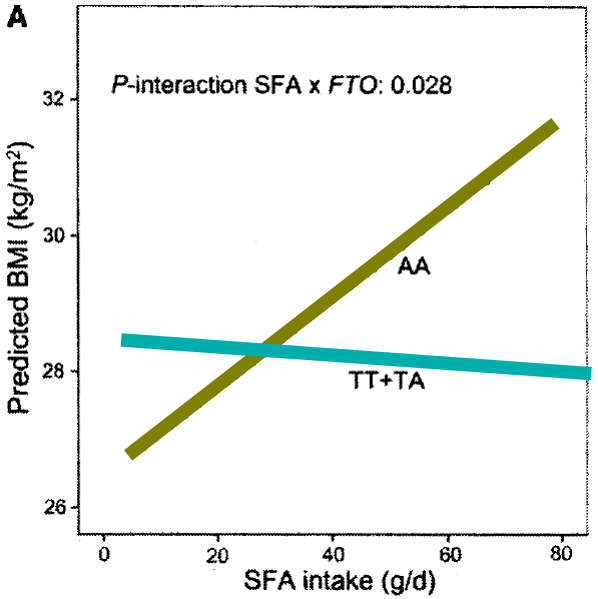
Sonestedt et al., 2009

Effects of saturated fatty acids on **BMI** according to the **FTO SNP rs9939609 genotype**



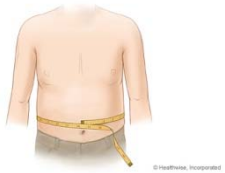
~ lower than 27 g/d

~ higher than 27 g/d

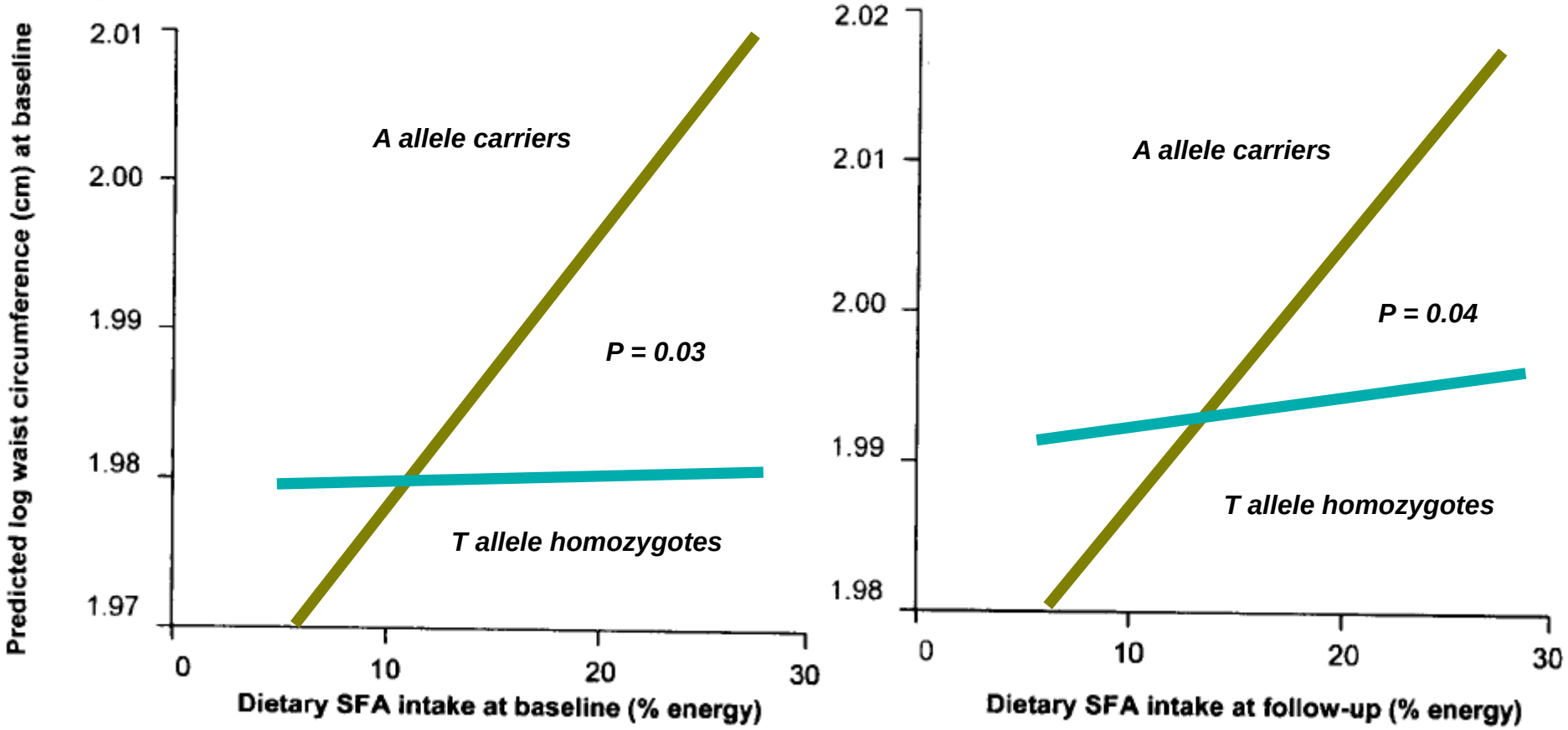


Adapted from Corella et al., 2011

Effects of saturated fatty acids on **adiposity** according to the **FTO SNP rs9939609 genotype**

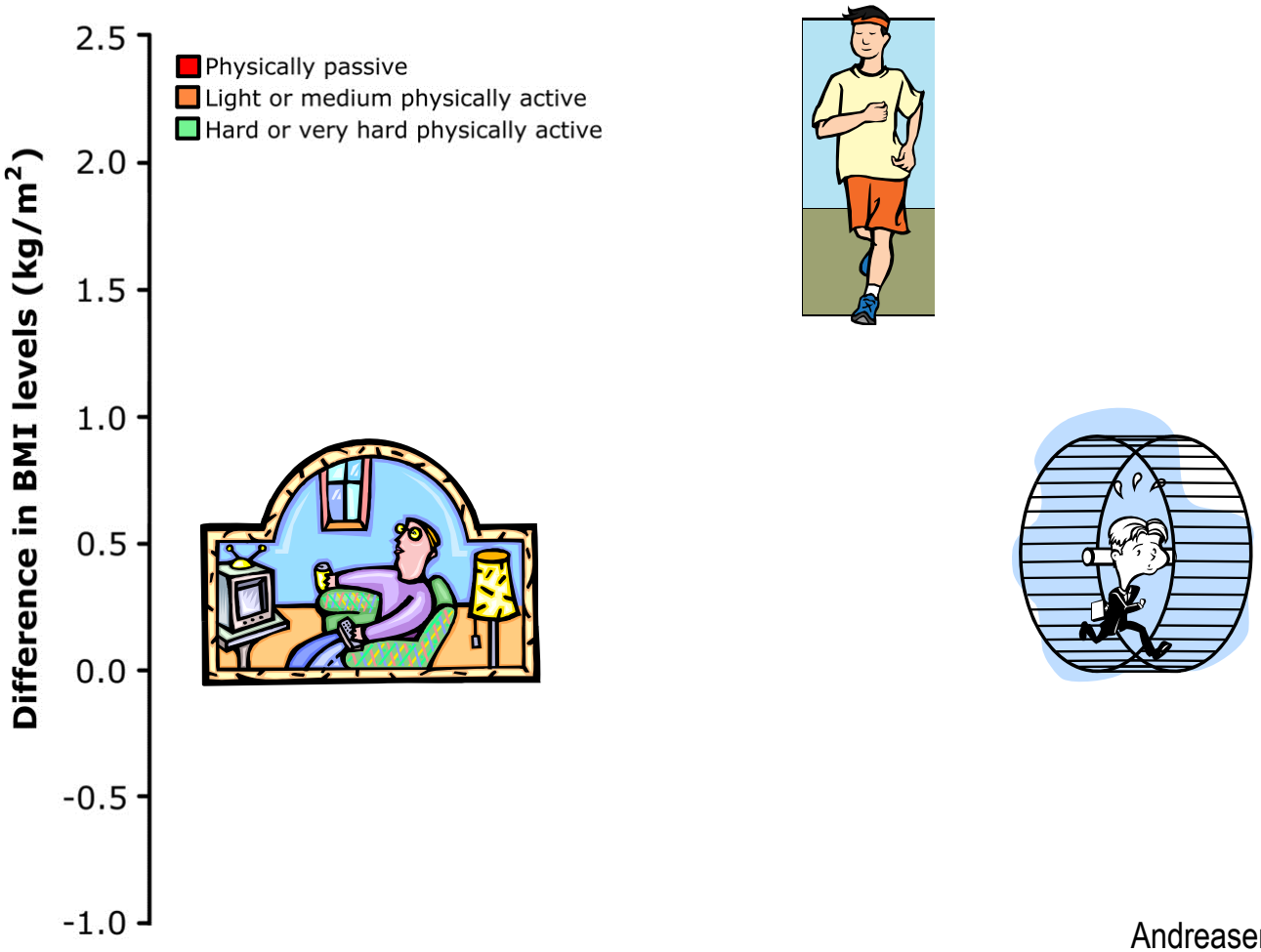


Baseline — — — — — → 7.5 years later



Adapted from Phillips et al., 2012

Physical activity modulates the relation between **FTO SNP rs9939609 genotype** and **BMI** (AA carriers have a higher BMI)



Andreasen et al., 2008


Fiber, exercise and genotype variety
modulate the effect of dietary fats on obesity

1. Do experimental animals fatten because of fat?
2. Some facts about the relation between dietary fats and eating behaviour.
3. Do epidemiological studies demonstrate that dietary fats make us fat?
4. Fiber, exercise, genetics: the modulating factors.
5. **A fa(s)t conclusion.**

A fa(s)t conclusion

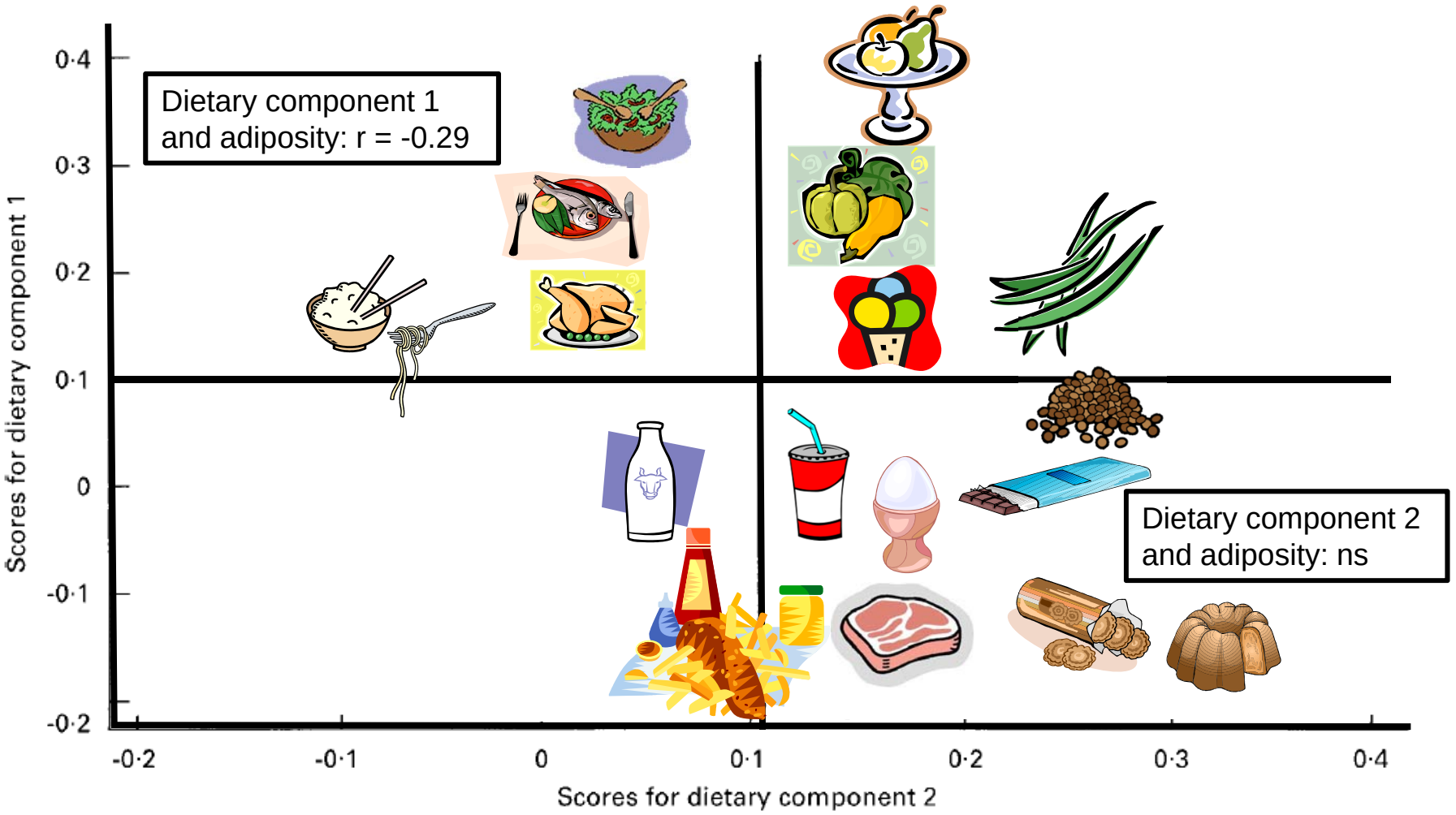
1. We eat foods not macronutrients
2. We select a diet and are resistant to be imposed one
3. We have many determinants of our eating behaviour and must compose with them

i.e., the A allele carriers of the FTO SNP rs9939609 genotype eat spontaneously more fat

Predictor	883 men and 1030 women — Obese	
	2001 →	2003
Dietary intake/eating behavior[a]		
Sweetened beverages	0.07*	0.05
Ordering supersized portions	0.19**	0.24**
Fruits and vegetables	0.01	−0.03
Milk	0.04	0.00
Whole grains	0.01	0.00
Eat while doing other activities	0.28**	0.24**
Eat home-prepared foods	0.16	0.13

adapted from Liebman et al., 2006

800 men and women



Adapted from Williams et al., 2000


We don't eat fats but foods, and the components
of eating behaviour should be considered more accurately


THANK YOU