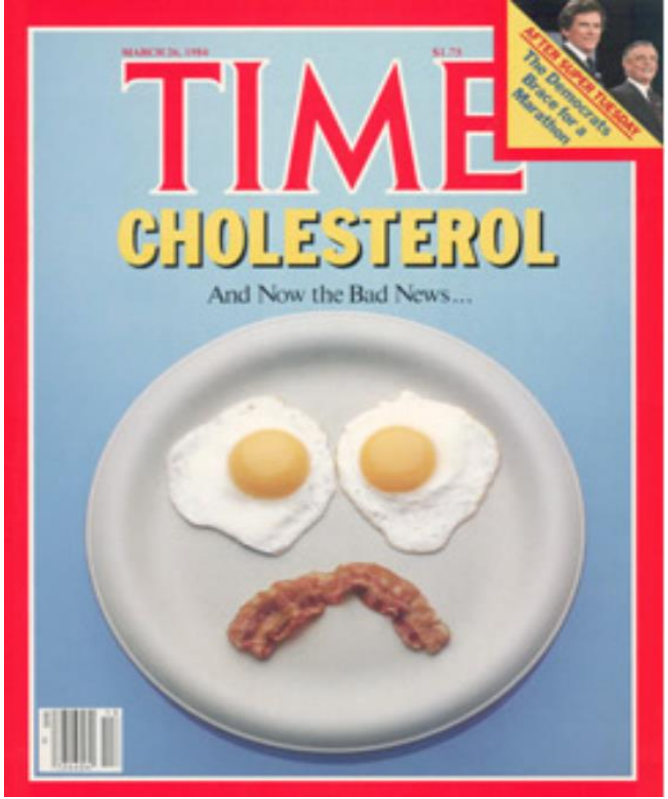
ACC Middle East Conference 2018

In partnership with:

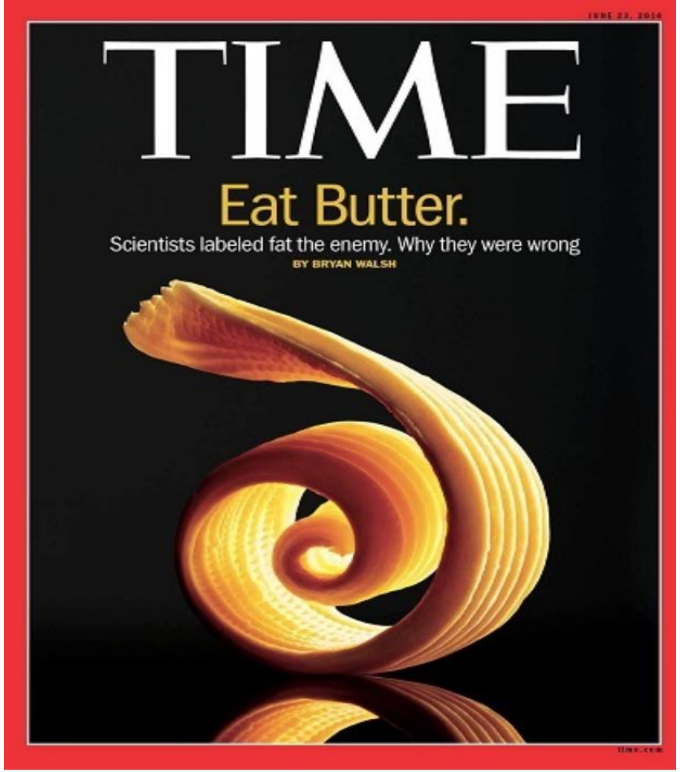
جمعية القلب السعودية
Saudi Heart Association

Low-Fat vs. Low-Carb Diets - What does the evidence tell us ?

Georges Saade, MD, FACC
Bellevue Medical Center
Associate Prof. Lebanese University



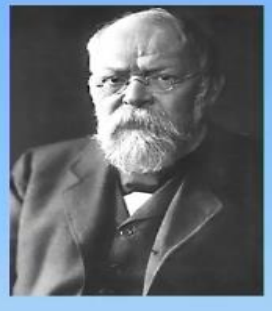
1984



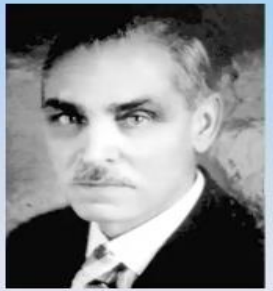
Time Magazine cover story in 2014.
Scientists were wrong about saturated fats.
They don't cause heart disease after all.

History of the Vilification of Fat

- ***1904*** – The term atherosclerosis is introduced by German Pathologist **Dr. Felix Marchand** (1846-1928) at the University of Leipzig suggests it is responsible for most obstructive processes in the arteries. From the Greek "athere" meaning gruel, and "skleros", meaning hard[1]



- ***1908*** – **Dr. Alexander Ignatowski** of the Imperial Medical Academy in St. Petersburg Russia fed rabbits full-fat milk, eggs, and meat and they developed yellow cobblestoning of the aorta which resembled atherosclerotic plaque[2]. This formulated the idea that something in the diet was clogging the arteries.



1. Marchand, F. 1904. "Ueber Atherosclerosis" Verhandlungen der Kongresse fur Innere Medizin. 21 Kongresse.
2. Ignatowski A. Changes in parenchymatous organs and in the aorta of rabbits under the influence of animal protein [in Russian]. Izvestia Imperatorskoi Voenno-Medicinskoi Akademii (St. Petersburg) 1908;18:231–44.

Dr. Nikolaj Anitschkow

(1885-1964)
Russian pathologist

#1

- ***1913*** –has just finished his PhD at the Imperial Medical Academy in St. Petersburg. He became interested in the work of Dr. Ignatowski.

- Over the next thirty years Dr. Anitschkow and his team determine that the material in the meat and eggs that produces the lesions is called cholesterol, and if rabbits are fed purified cholesterol instead of meat and eggs they develop even bigger plaques[1,2].
- These experiments became widely known, and replicated in sheep, cows, horses. His conclusion: "cholesterol in diet (eg. eggs, meat) causes heart disease"
- But these animals are strict herbivores and not evolved to eat meat. Less well known parallel experiments on dogs and rats (natural meat eaters) failed to produce lesions. And the cholesterol levels in rabbits fed pure cholesterol was five times what is seen in a human. The rabbits also accumulated cholesterol in connective tissues– they couldn't eliminate it[3].
- These lesions could be also produced in a wide variety of animals fed an almost entirely plant-based diet which doesn't contain cholesterol, but this didn't seem relevant at the time.

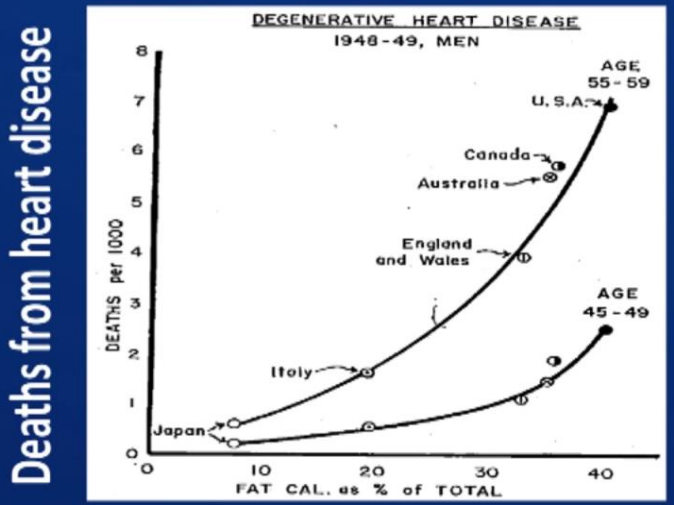
1. Anitschkow N, Chalatow S. Ueber experimentelle Cholester- insteatose und ihre Bedeutung fuer die Entstehung einiger pathologischer Prozesse. Zentrbl Allg Pathol Pathol Anat 1913;24:1-9.
2. Anitschkow N, Chatatow S. (translated by Mary Z. PeliasJ). 1983. Classics in arteriosclerosis research: On experimental cholesterin steatosis and its significance in the origin of some pathological processes by N. Anitschkow and S. Chalatow, 1913. Arteriosclerosis 1983;3: 178-82.
3. Shull K, Mann, GV, Andrus SB, and Stare FJ. 1954. Response of Dogs to Cholesterol Feeding. American Journal of Physiology Published 28 February 1954 Vol. 176 no. 475-482

The Diet - Heart Hypothesis: Conventional Wisdom

Total fat, Saturated fat → Serum total & LDL cholesterol → Coronary heart disease

The Original Evidence: Ecological Data from 6 countries

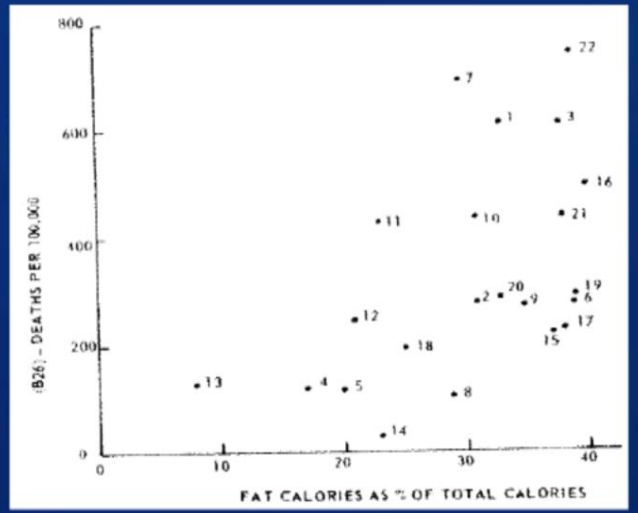
6 Countries [1]



Deaths from heart disease

Fat intake, % of energy

22 Countries [2]

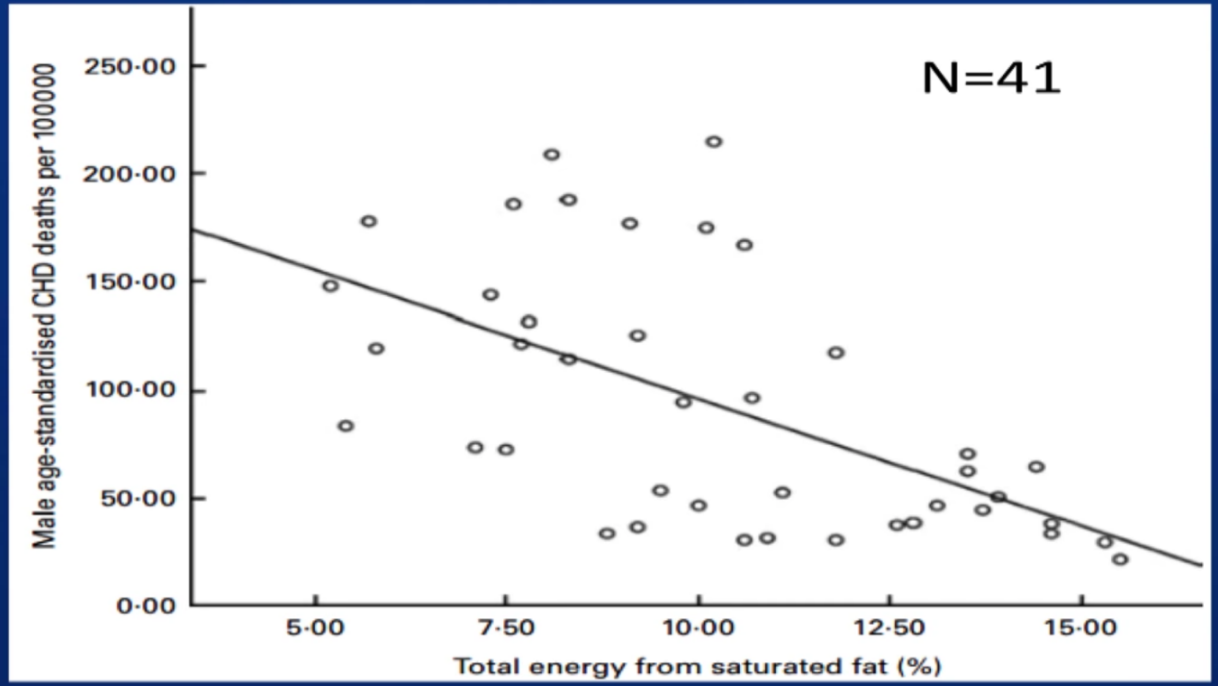


Fat intake, % of energy

[1] Keys A, 1953. *J Mt Sinai Hosp*

[2] Yerushalmy and Hillebow, 1957. *NY State J Med*

Saturated fat intake and CHD mortality among men in Europe, 1998



CHD deaths per 100,000 †

Total energy from saturated fat (%)

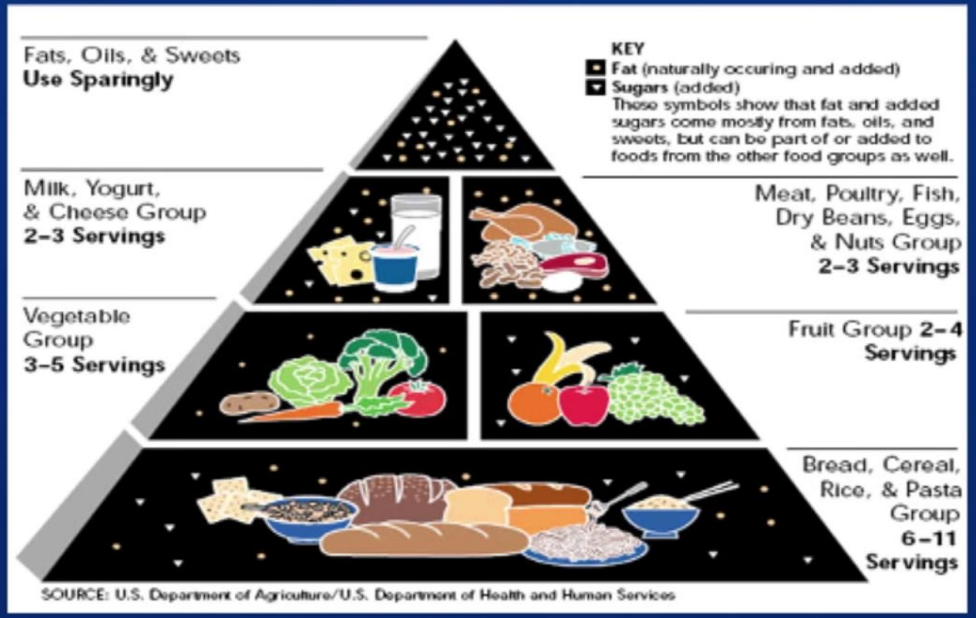
$R^2 = 0.339$, $P<0.01$

Results were similar for women and for CHD & stroke outcomes (all $P<0.01$)

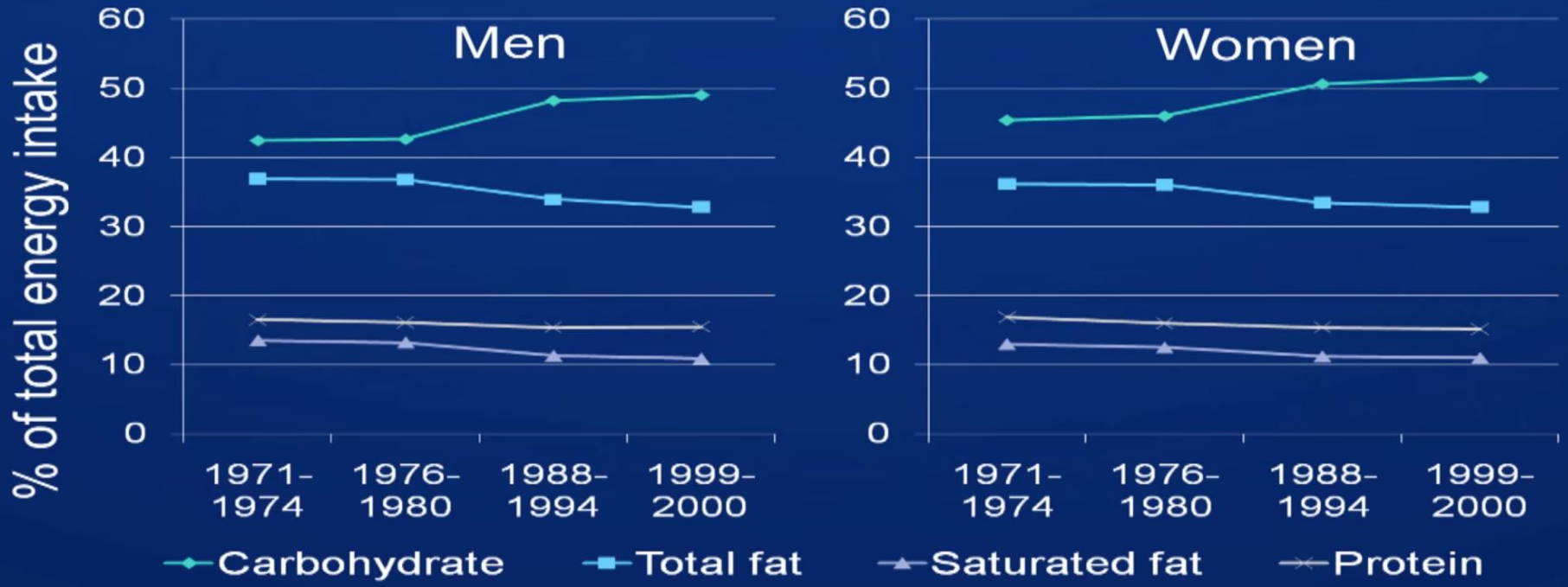
† age-standardized rates

Hoenselaar R. *Br J Nutr* 2012;108:939–942

1961: American Heart Association adopts low-fat diet to fight heart disease



Trends in macronutrient intake, United States, 1971-2000



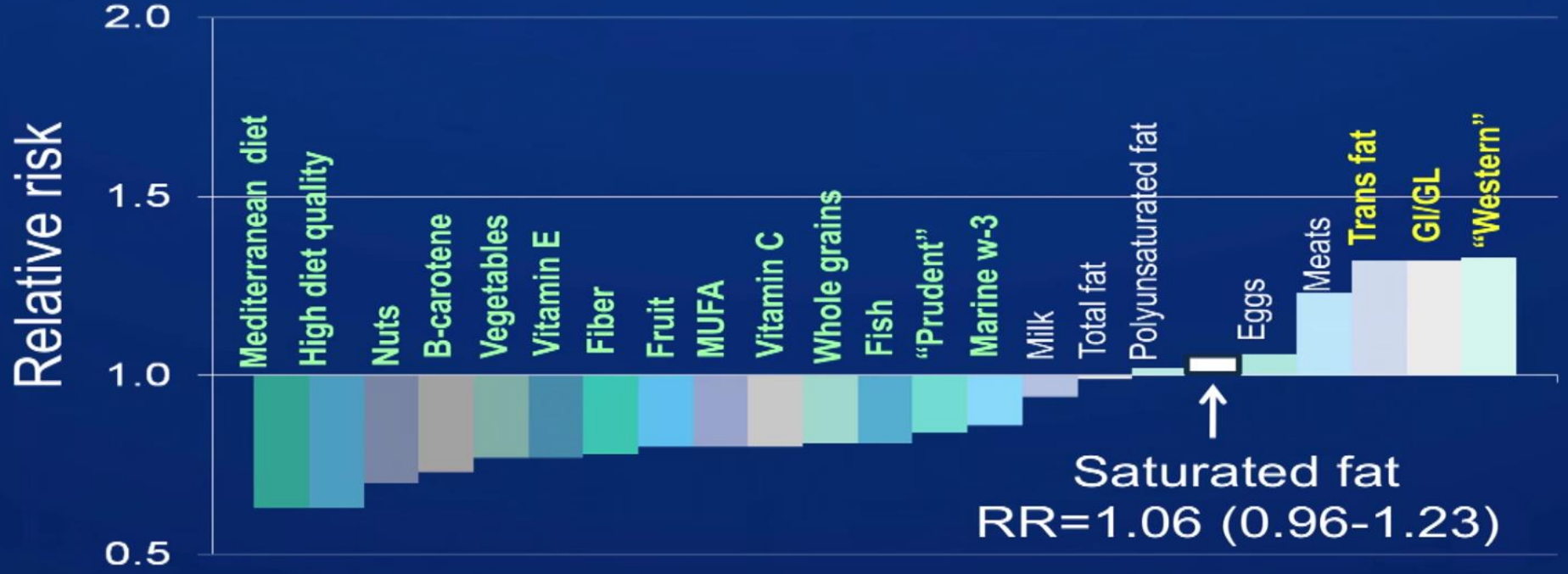
http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5304a3.htm

Dietary guidelines by various health organizations

Nutrients	IOM/USDA	AHA	NCEP	WHO
Carbohydrate	45-65%			55-75%
Total fat	20-35%	<30%	<30%	15-30%
Saturated fatty acids	**As low as possible (<10%)**	**<7%**	**<7%**	**<10%**

- Natural foods containing saturated fat also contain
  - Vitamins B1, B2, B6, B11, B12
  - Protein
  - Zinc
  - Magnesium
  - Retinol
  - Selenium
  - Calcium
  - Vitamin D
- May result in inadequate intake of key nutrients in certain populations

Relative risk of each dietary exposure in relation to CHD in cohort studies



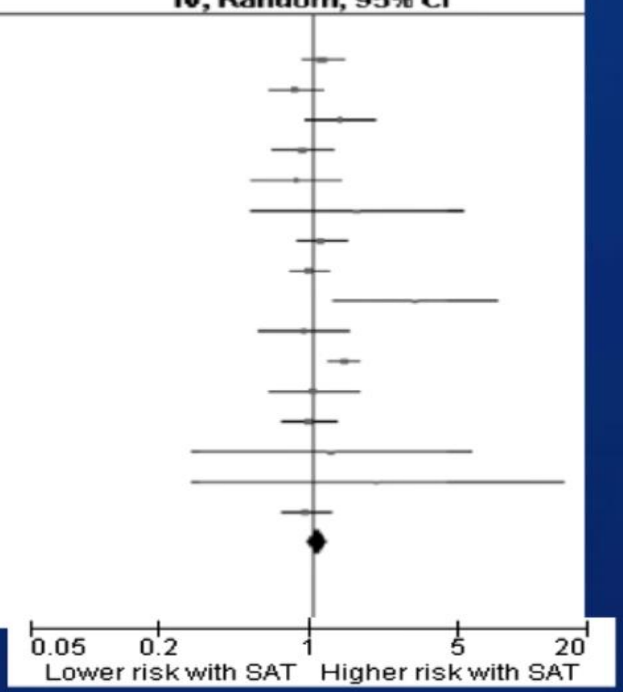
Mente A et al, 2009, *Arch Int Med* 169:659-669

Saturated fat intake and CHD

Study or Subgroup	Risk Ratio IV, Random, 95% CI	Year
Coronary Heart Disease		
Shekelle et al(17)	1.11 [0.91, 1.36]	1981
McGee et al(9)[1]	0.86 [0.67, 1.12]	1984
Kushi et al(13)	1.33 [0.95, 1.87]	1985
Posner et al(16)	0.92 [0.68, 1.24]	1991
Goldbourt et al(35)[1]	0.86 [0.56, 1.35]	1993
Fehily et al(28)	1.57 [0.56, 4.42]	1994
Ascherio et al(4)[1]	1.11 [0.87, 1.42]	1996
Esrey et al(6)	0.97 [0.80, 1.18]	1996
Mann et al(32)	2.77 [1.25, 6.13]	1997
Pietinen et al(15)	0.93 [0.60, 1.44]	1997
Boniface et al(5)[1]	1.37 [1.17, 1.60]	2002
Jakobsen et al(8)[1]	1.03 [0.66, 1.60]	2004
Oh et al(33)	0.97 [0.74, 1.27]	2005
Tucker et al(18)[1]	1.22 [0.31, 4.77]	2005
Xu et al(10)	1.91 [0.31, 11.84]	2006
Leosdottir et al(14)	0.95 [0.74, 1.21]	2007
Subtotal (95% CI)	**1.07 [0.96, 1.19]**	

Heterogeneity: $Tau^2 = 0.02$; $Chi^2 = 25.54$, df = 15 (P = 0.04); $I^2 = 41\%$

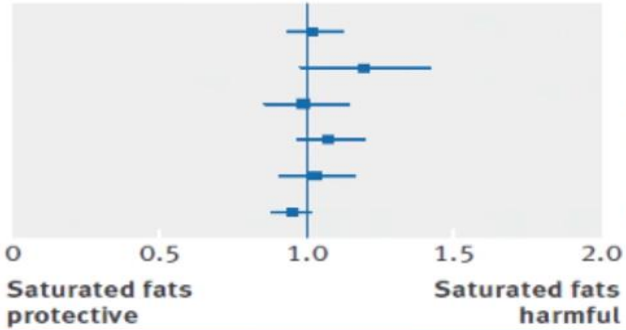
Test for overall effect: Z = 1.22 (P = 0.22)



Siri-Tarino et al, Am J Clin Nutr 2010

Summary RRs of saturated fat intake and various health outcomes

Outcome	No of studies /comparisons	No of events /participants	Relative risk (95% CI)	P	P_{het}	I^2 (%)
All cause mortality	5/7	14 090/99 906	0.99 (0.91 to 1.09)	0.91	0.17	33
CHD mortality	11/15	2970/101 712	1.15 (0.97 to 1.36)	0.10	<0.001	70
CVD mortality	3/5	3792/90 501	0.97 (0.84 to 1.12)	0.69	0.29	19
CHD total	12/17	6383/267 416	1.06 (0.95 to 1.17)	0.29	0.02	47
Ischemic stroke	12/15	6226/339 090	1.02 (0.90 to 1.15)	0.79	0.002	59
Type 2 diabetes	8/8	8739/237 454	0.95 (0.88 to 1.03)	0.20	0.61	0



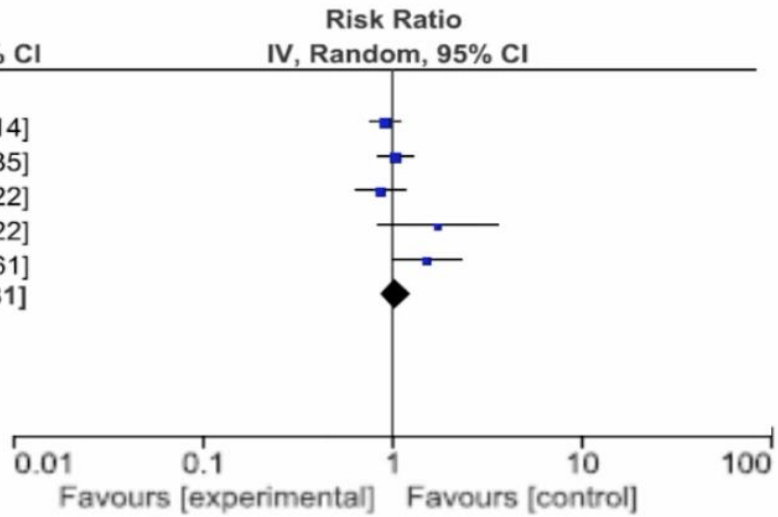
De Souza RJ, Mente A, et al. 2015. BMJ 351:h3978

Meta-analysis of RCTs: SFA vs. CHD (Adequately Controlled)

Study or Subgroup	Experimental Events	Experimental Total	Control Events	Control Total	Weight	Risk Ratio IV, Random, 95% CI
1.1.1 Adequately Controlled Trials						
DART	132	1018	144	1015	16.2%	0.91 [0.73, 1.14]
MCS	131	4580	121	4477	15.6%	1.06 [0.83, 1.35]
MRCT	45	199	51	194	12.8%	0.86 [0.61, 1.22]
RCOT	12	28	6	26	4.9%	1.86 [0.82, 4.22]
SDHS	36	221	24	237	9.7%	1.61 [0.99, 2.61]
Subtotal (95% CI)		**6046**		**5949**	**59.3%**	**1.06 [0.86, 1.31]**
Total events	356		346			

Heterogeneity: $Tau^2 = 0.02$; $Chi^2 = 7.42$, df = 4 (P = 0.12); $I^2 = 46\%$

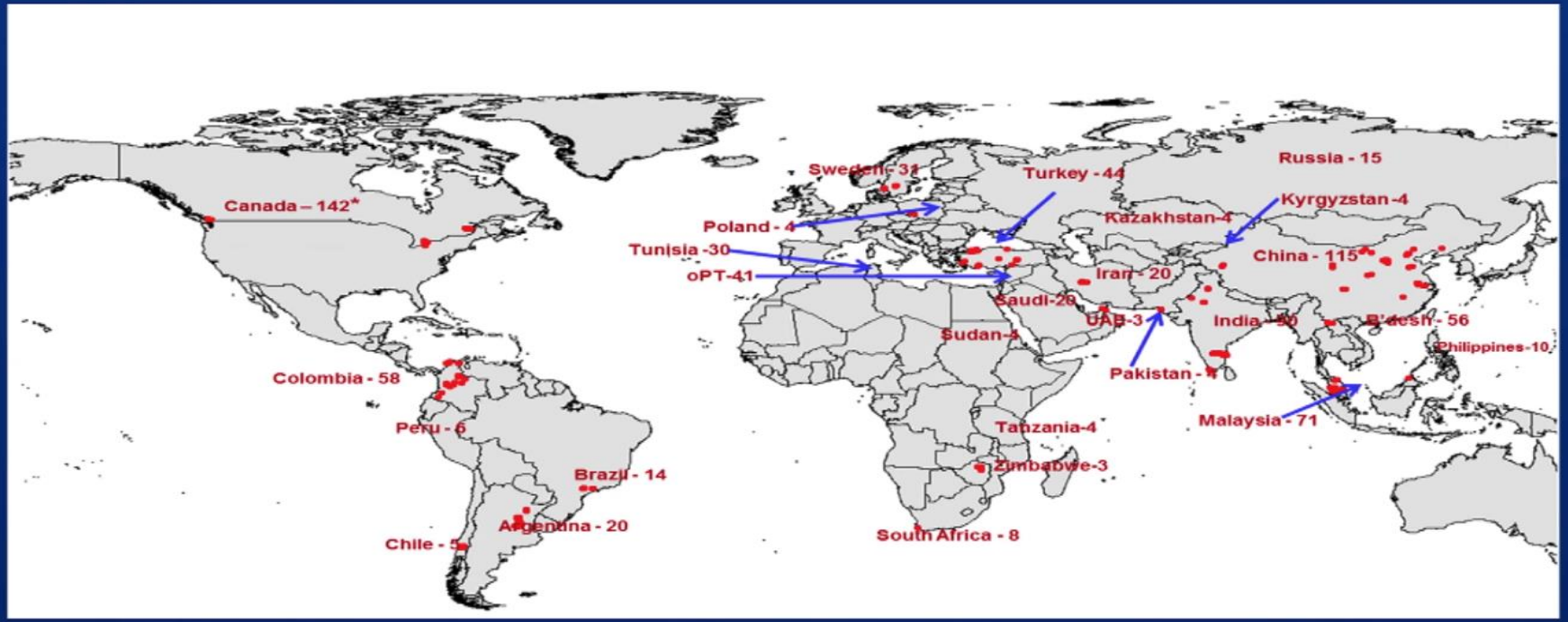
Test for overall effect: Z = 0.54 (P = 0.59)



	Experimental	Control	Risk Ratio (95% CI)
Total events	356	346	1.06(0.86, 1.31)

Hamley S, 2017. Nutrition J

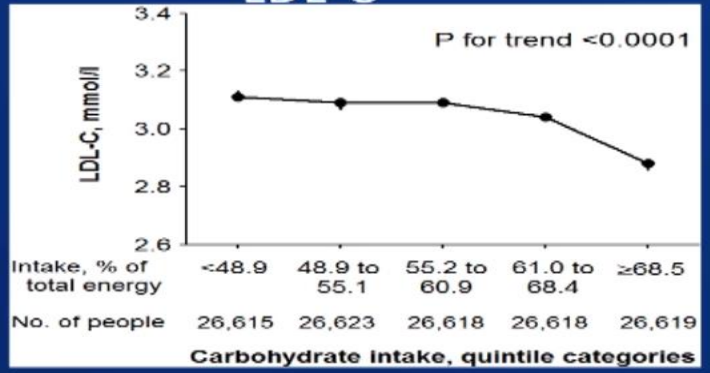
PURE: 135,335 from 667 communities in 18 (Phase 1) countries from 5 continents



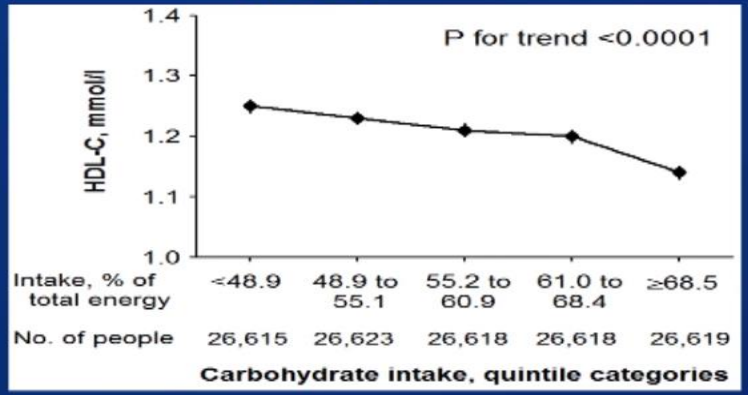
Target: 200,000 people

Carbohydrate intake versus risk markers

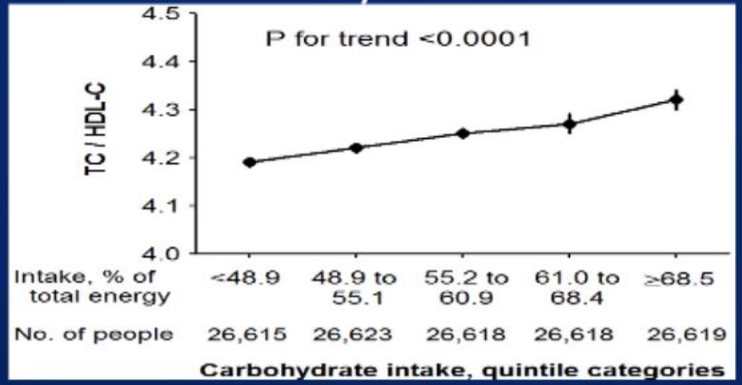
LDL-C



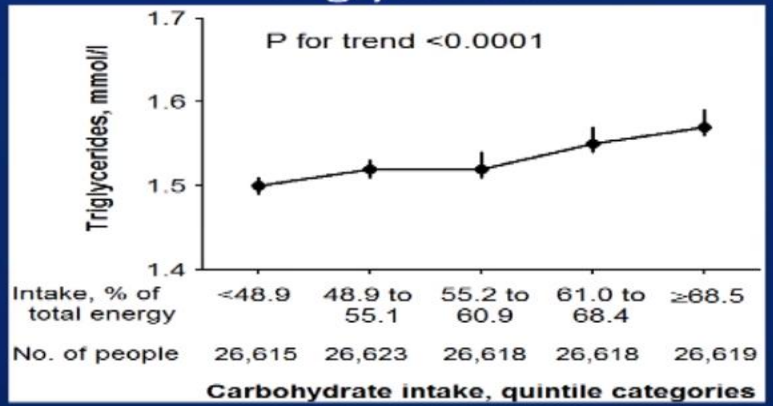
HDL-C



TC / HDL-C

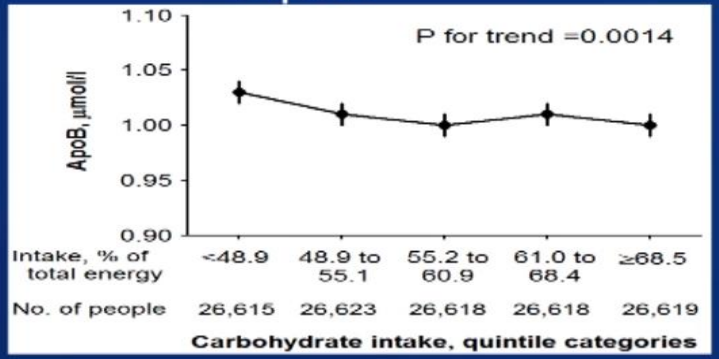


Triglycerides

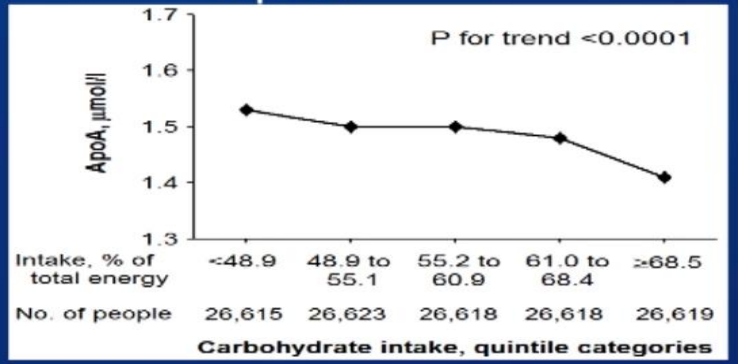


Carbohydrate intake versus risk markers

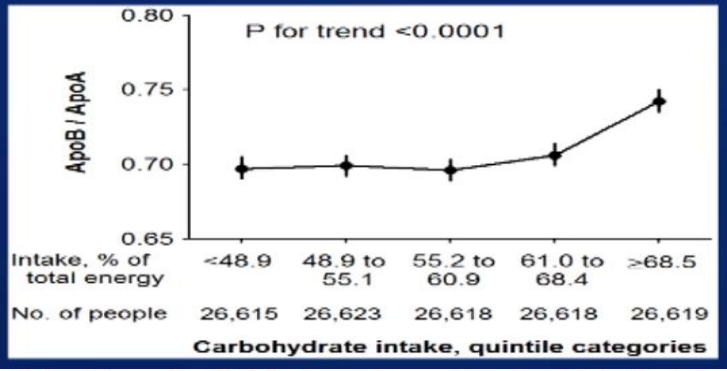
ApoB



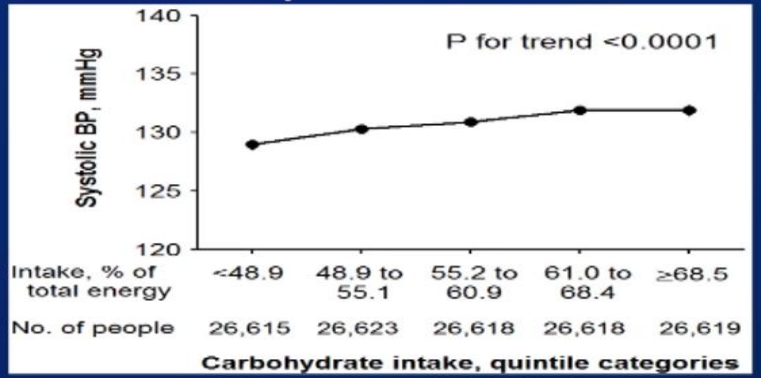
ApoA



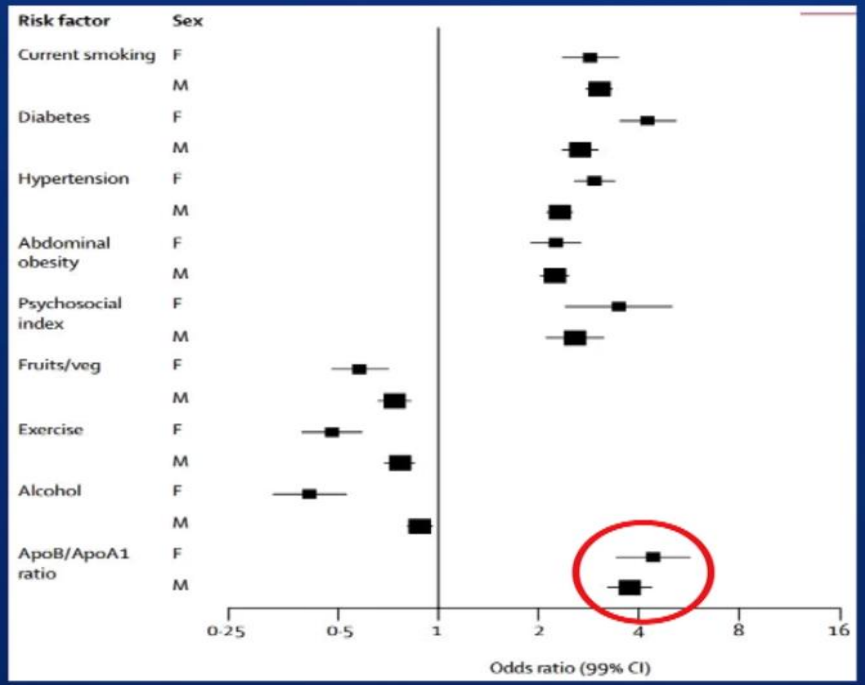
ApoB / ApoA

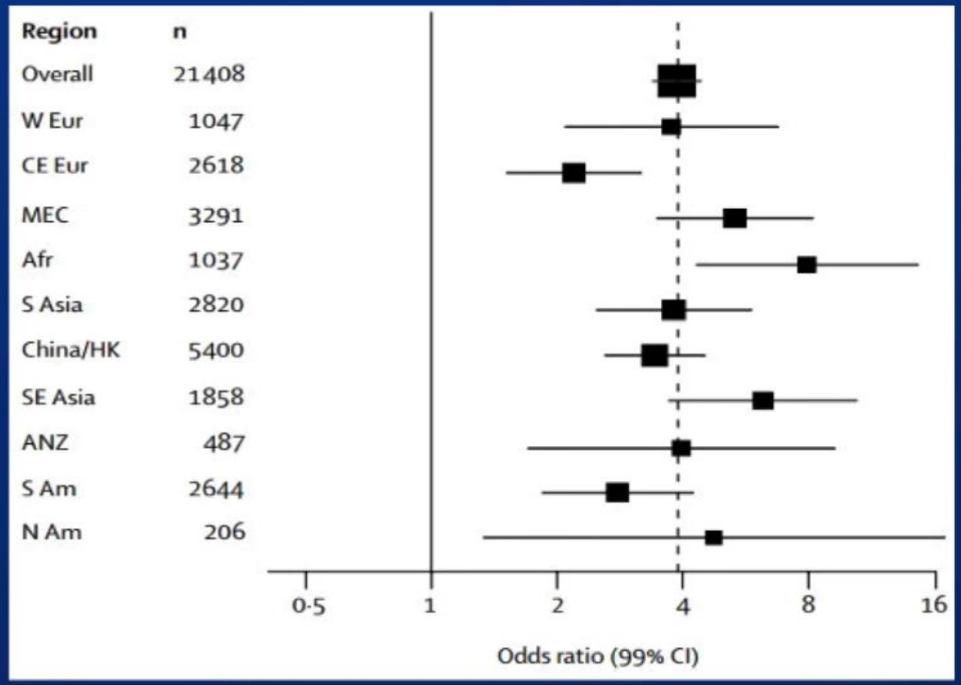


Systolic BP



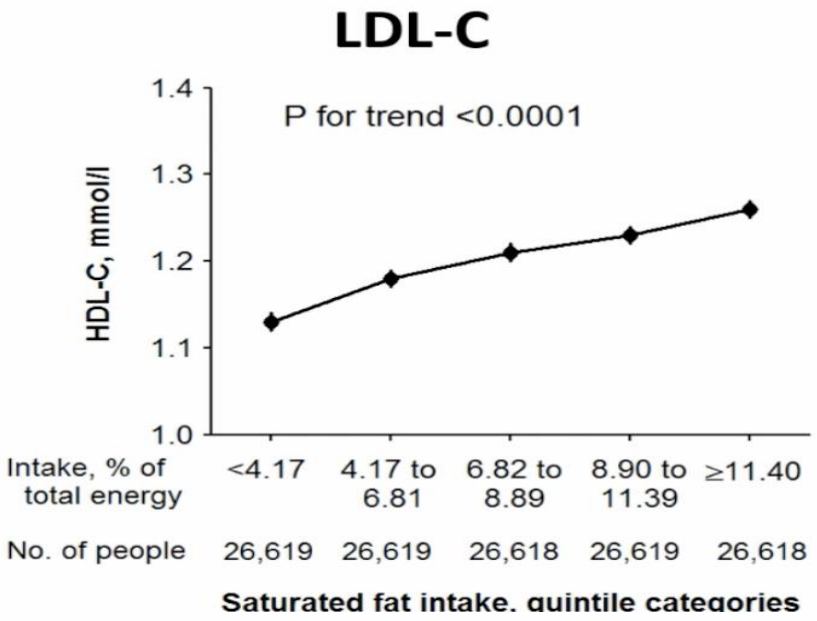
ApoB/ApoA ratio was the strongest risk marker of MI and stroke in INTERHEART and INTERSTROKE

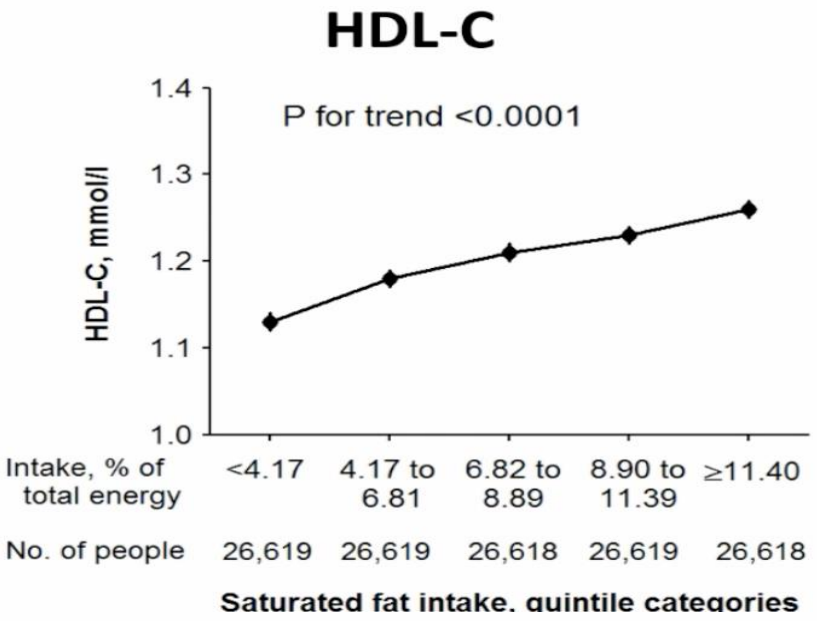




Yusuf S, et al, 2004, Lancet

PURE: Saturated fat intake and blood lipids

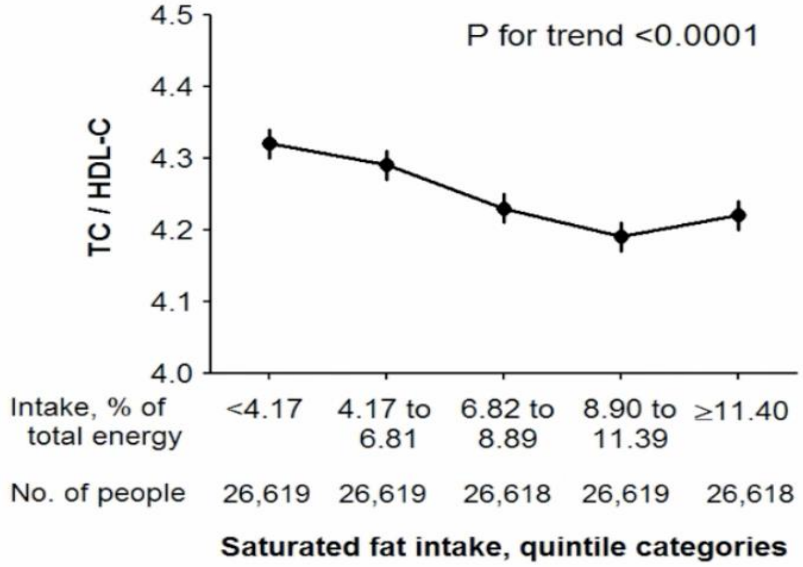




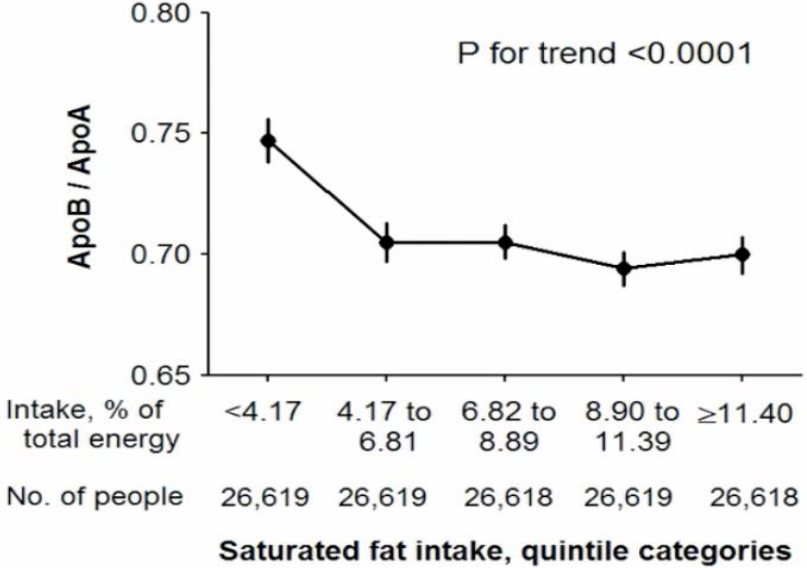
Mente A, et al, 2017. Lancet Diabetes Endocrinol

PURE: Saturated fat intake and blood lipids

TC/HDL-C



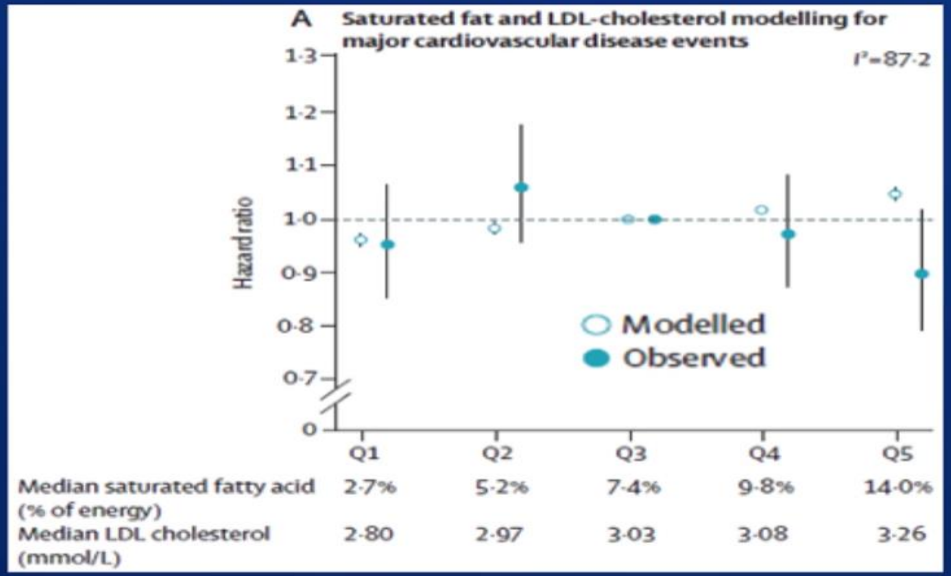
ApoB/ApoA



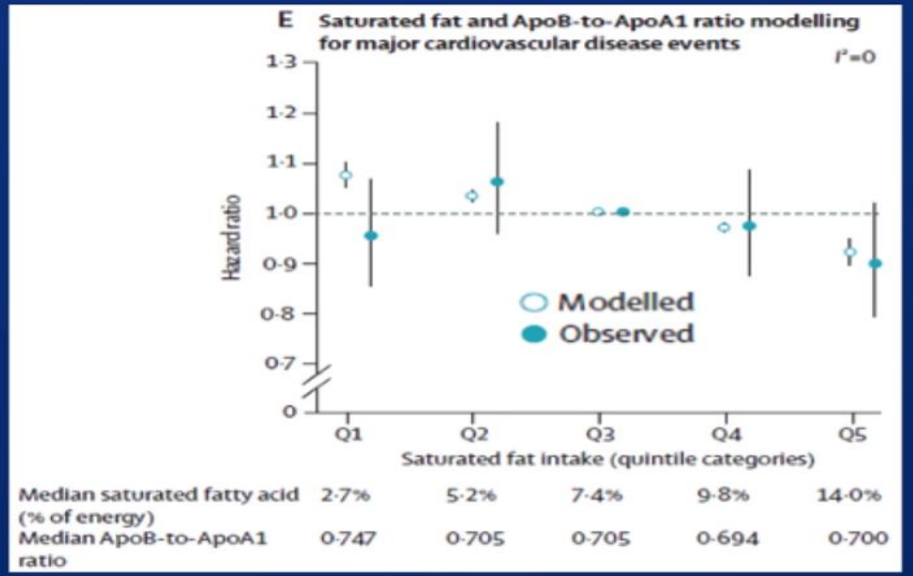
Mente A, et al, 2017. Lancet Diabetes Endocrinol

Simulation modelled versus observed hazard ratio of the association between sat. fat & CVD events

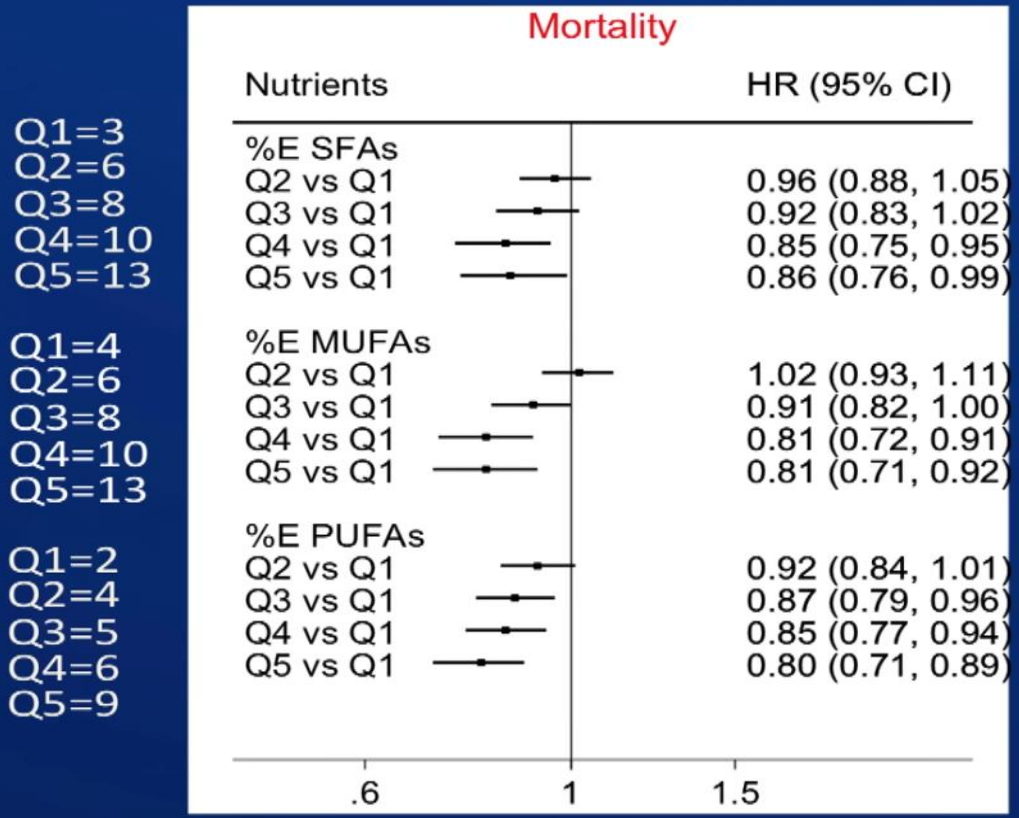
LDL-C

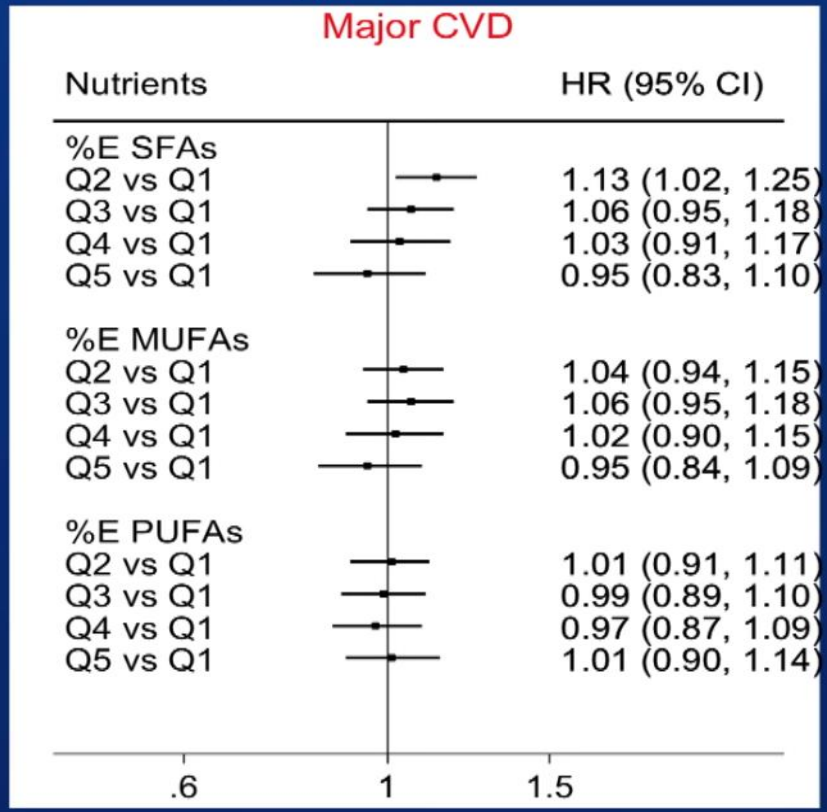


ApoB/ApoA



Risk of mortality and major CVD by type of fat





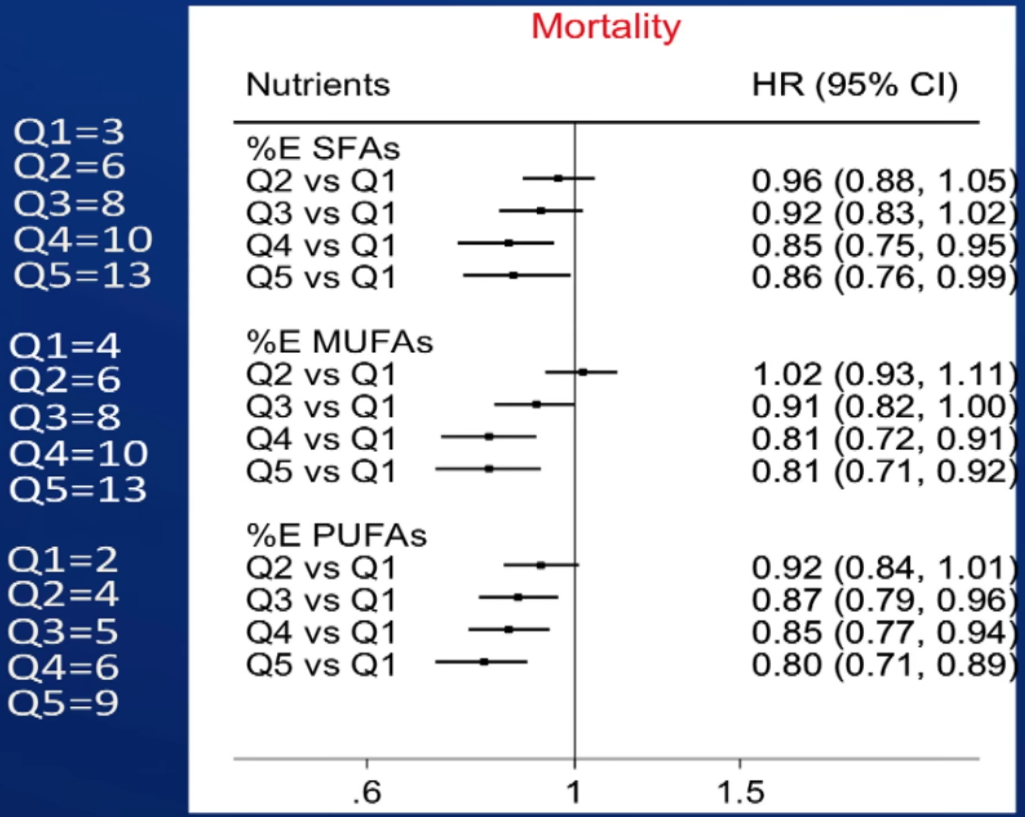
Q1=3
Q2=6
Q3=8
Q4=10
Q5=13

Q1=4
Q2=6
Q3=8
Q4=10
Q5=13

Q1=2
Q2=4
Q3=5
Q4=6
Q5=9

Adjusted for age, sex, activity, location, smoking, educ, WHR, energy, and centre (random effect)

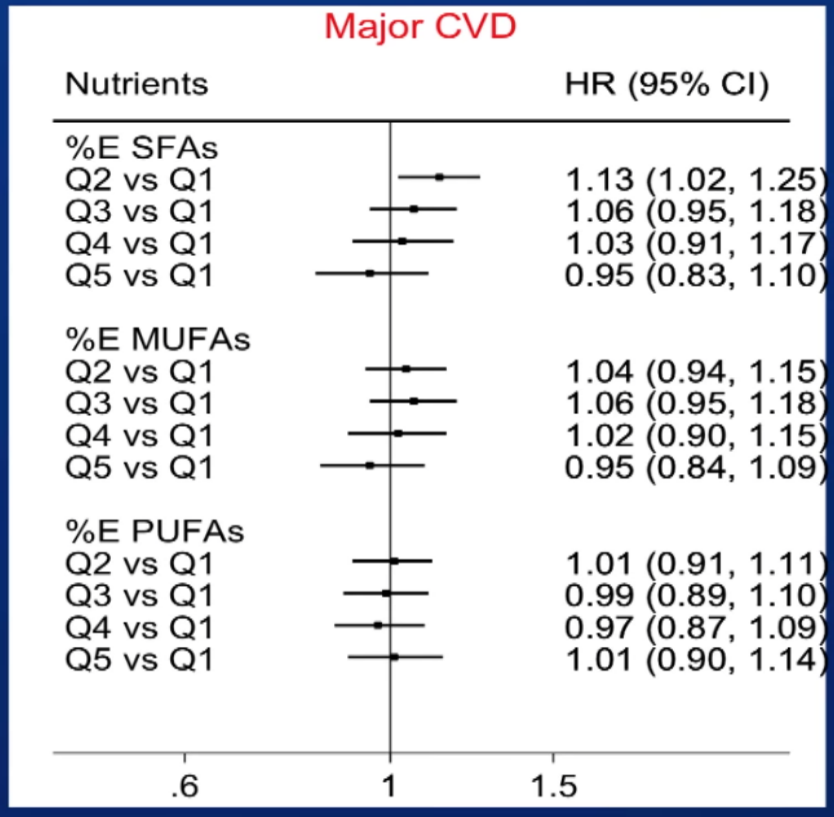
Risk of mortality and major CVD by type of fat



Q1=3
Q2=6
Q3=8
Q4=10
Q5=13

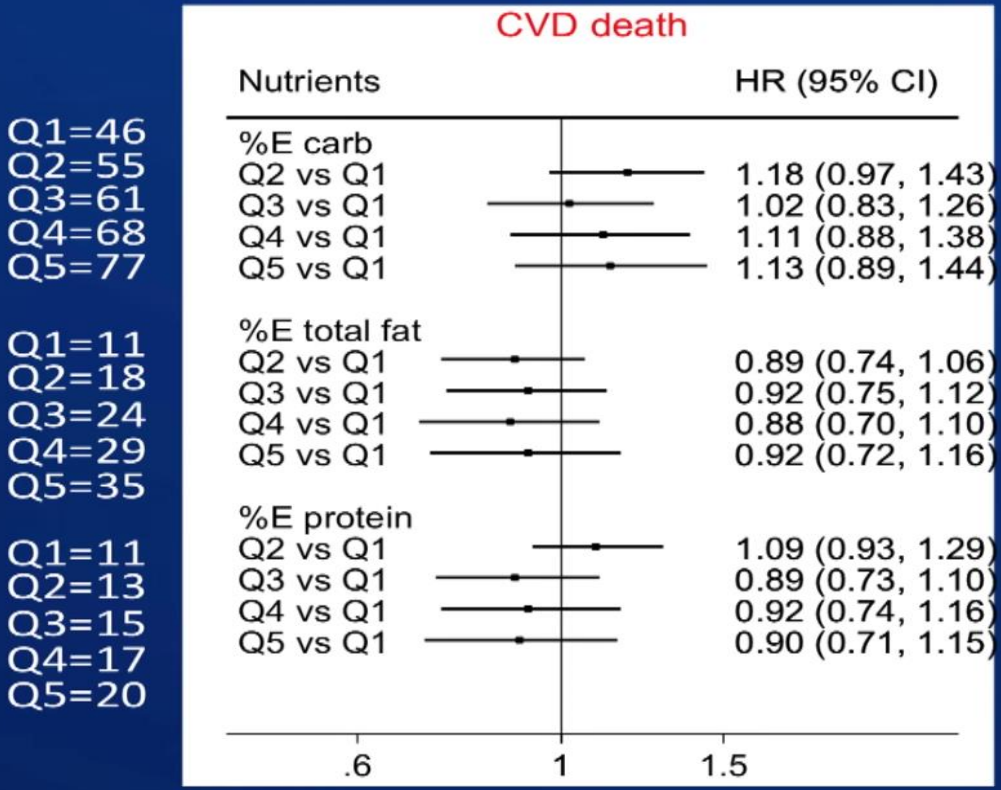
Q1=4
Q2=6
Q3=8
Q4=10
Q5=13

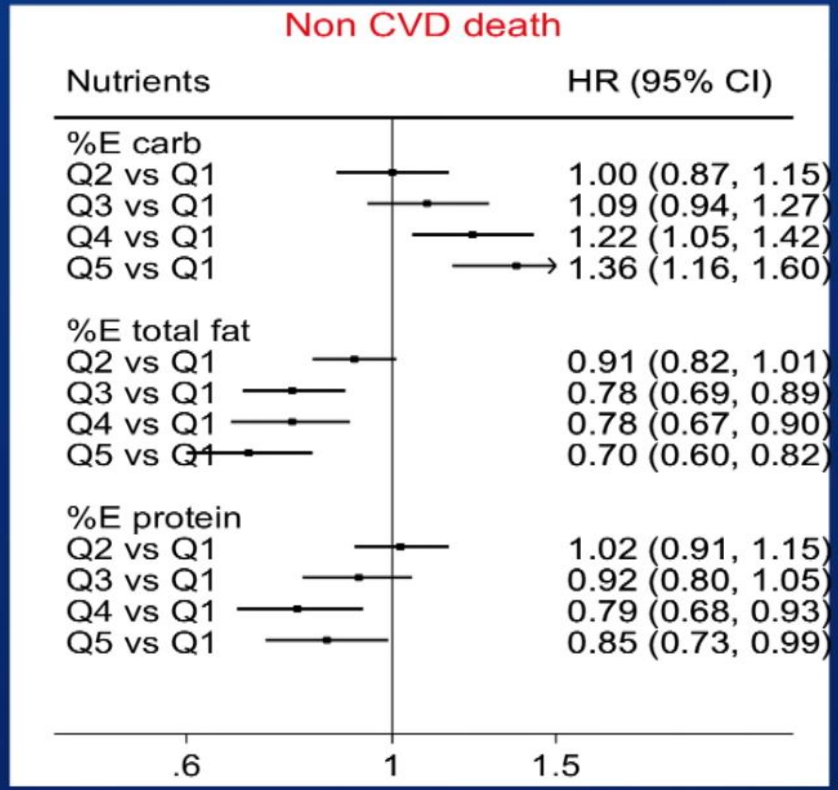
Q1=2
Q2=4
Q3=5
Q4=6
Q5=9



Adjusted for age, sex, activity, location, smoking, educ, WHR, energy, and centre (random effect)

Risk of CVD and non-CVD death by macronutrient intake





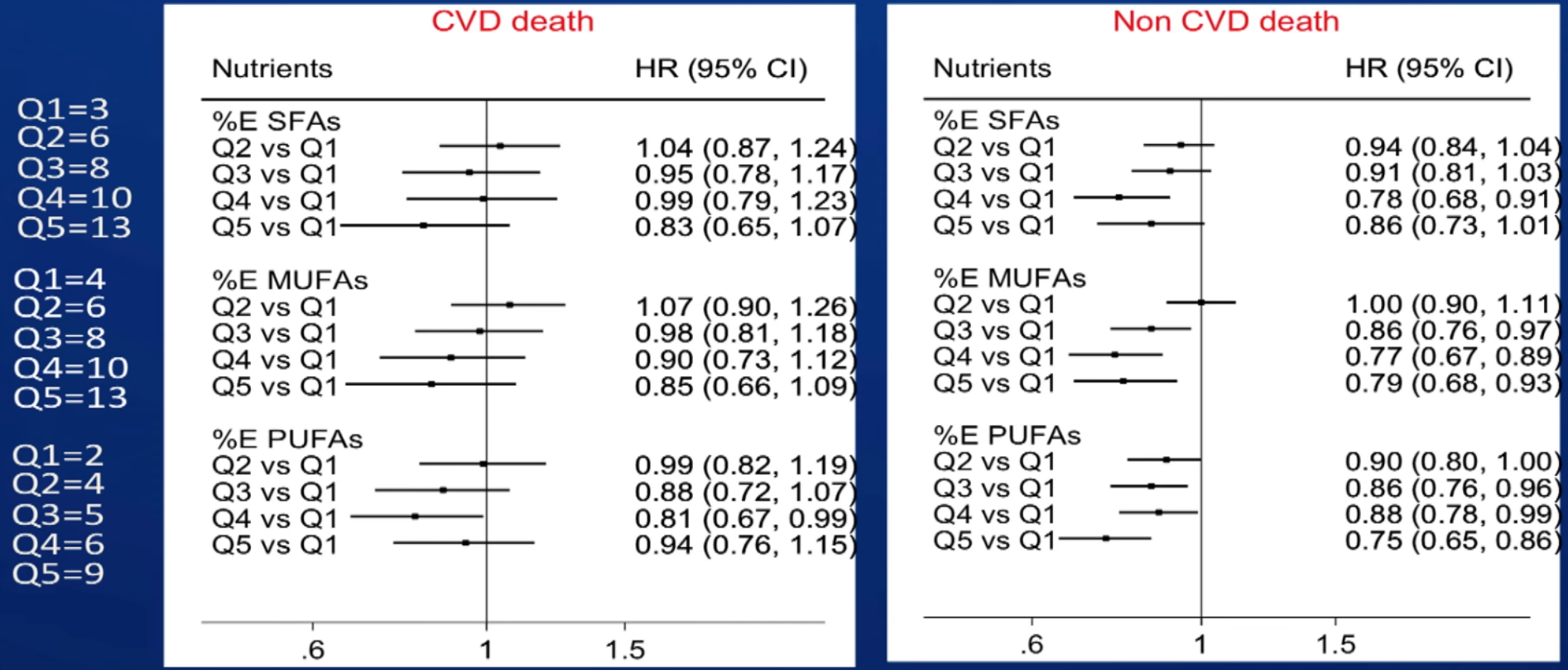
Q1=46
Q2=55
Q3=61
Q4=68
Q5=77

Q1=11
Q2=18
Q3=24
Q4=29
Q5=35

Q1=11
Q2=13
Q3=15
Q4=17
Q5=20

Adjusted for age, sex, activity, location, smoking, educ, WHR, energy, and centre (random effect)

Risk of CVD and non-CVD death by type of fat



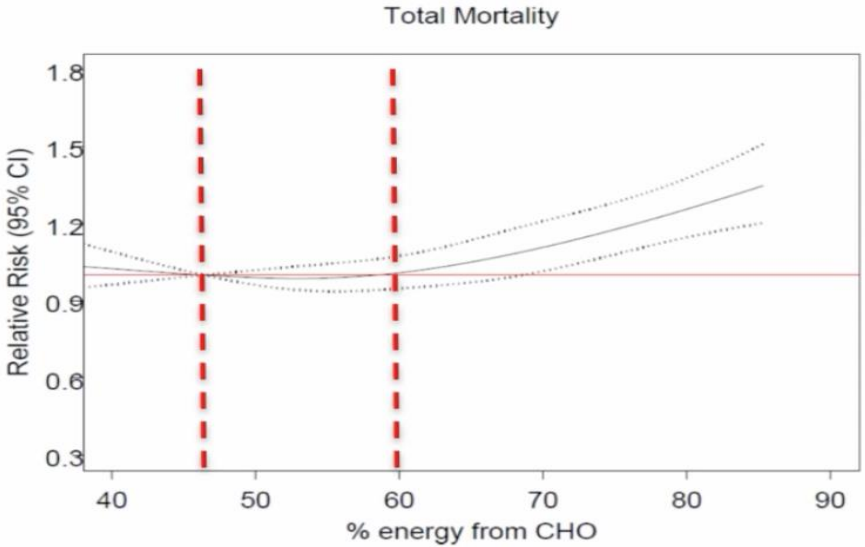
Q1=3
Q2=6
Q3=8
Q4=10
Q5=13

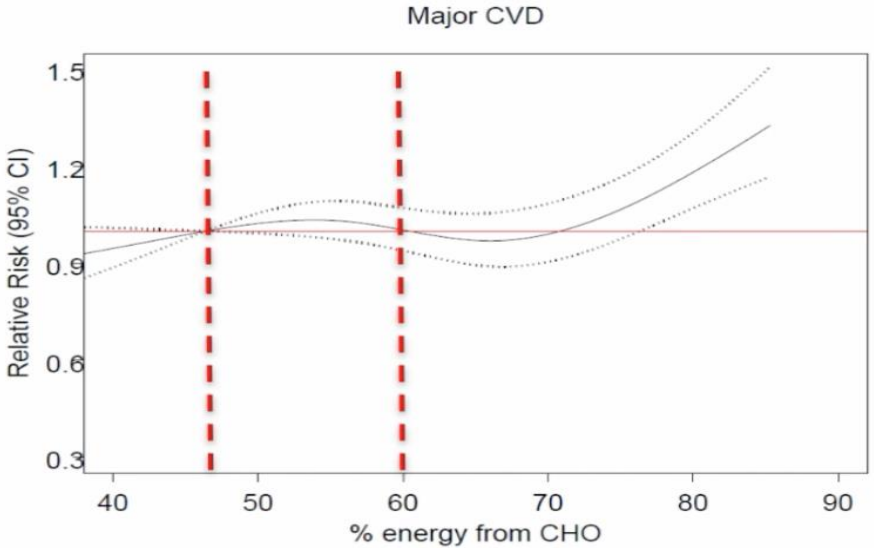
Q1=4
Q2=6
Q3=8
Q4=10
Q5=13

Q1=2
Q2=4
Q3=5
Q4=6
Q5=9

Adjusted for age, sex, activity, location, smoking, educ, WHR, energy, and centre (random effect)

PURE: % energy from carbohydrate and clinical outcomes:





Dehghan M et al, 2017. Lancet

Conclusions and implications

- A high carbohydrate diet (>50-55%E) is associated with higher risk of mortality
- Fats, including saturated and unsaturated fats, are associated with lower risk of mortality
- No association between total fat, types of fat and CVD events

Thank you