

Good Fat, Bad Fat How Bad IS Bad?



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The Path Ahead

- 🔥 What is fat & what does it do?
- 🔥 Dietary recommendations
- 🔥 Fat & heart disease
- 🔥 Fat & cholesterol
- 🔥 How bad is saturated fat?
- 🔥 Can fat and cholesterol be good?
- 🔥 Final remarks



WHAT IS FAT & WHAT DOES IT DO?



Fatty Acids



stearic



linolenic



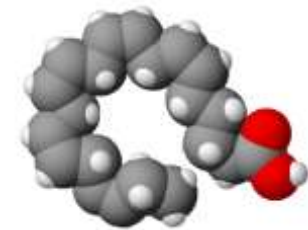
arachidonic



oleic



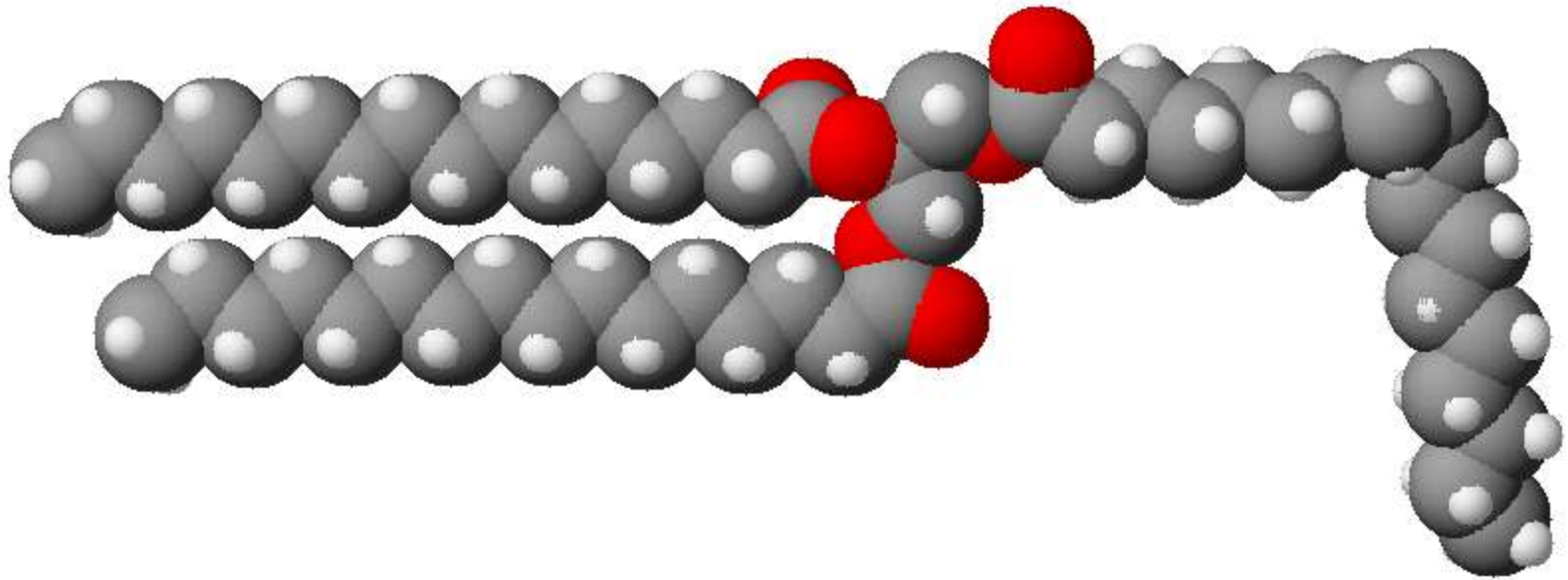
linoleic



docosahexaenoic



Triglyceride



Function of Fat in the Body

- 🔥 Provide energy
- 🔥 Insulation
- 🔥 Protection of vital organs
- 🔥 Form structural materials of tissues & cells
- 🔥 Carry fat soluble vitamins (A, D, E & K)
- 🔥 Used as starting points for synthesis of important biologically active molecules



Composition of Common Fats

Fat	Lauric	Myristic	Palmitic	Stearic	Oleic	Linoleic	Linolenic	Other
Human	-	2.7	24.0	8.4	46.9	10.2	-	7.8
Beef tallow	-	6.3	27.4	14.1	49.6	2.5	-	0.1
Lard	-	1.3	28.3	11.9	47.5	6.0	-	5.0
Butter	2.5	11.1	29.0	9.2	26.7	3.6	-	17.9
Palm oil	0.2	1.1	44.1	4.4	39.0	10.6	0.3	0.3
Palm kernel oil	47.8	16.3	8.5	2.4	15.4	2.4	-	7.2
Coconut oil	47.8	18.1	8.9	2.7	6.4	1.6	-	14.5
Olive oil	-	-	12.9	2.9	74.6	8.4	0.7	0.5
Cottonseed oil	-	-	25.3	2.4	17.3	54.2	0.2	0.6
Rapeseed oil	-	-	3.6	1.5	61.6	21.7	9.6	2.0
Soybean oil	-	-	11.0	4.0	23.4	53.2	7.8	0.6
Sunflower oil	-	-	6.3	3.7	24.3	65.3	0.2	0.2



DIETARY RECOMMENDATIONS & OBESITY



Dietary Recommendations

UK Government:

- plenty of starchy foods such as rice, bread, pasta and potatoes (choosing wholegrain varieties when possible)
- plenty of fruit and vegetables; at least 5 portions of a variety of fruit and vegetables a day
- moderate amounts of protein-rich foods such as meat, fish, eggs and alternatives such as nuts and pulses
- moderate amounts of milk and dairy, choosing reduced fat versions or eating smaller amounts of full fat versions or eating them less often
- less saturated fat, salt and sugar



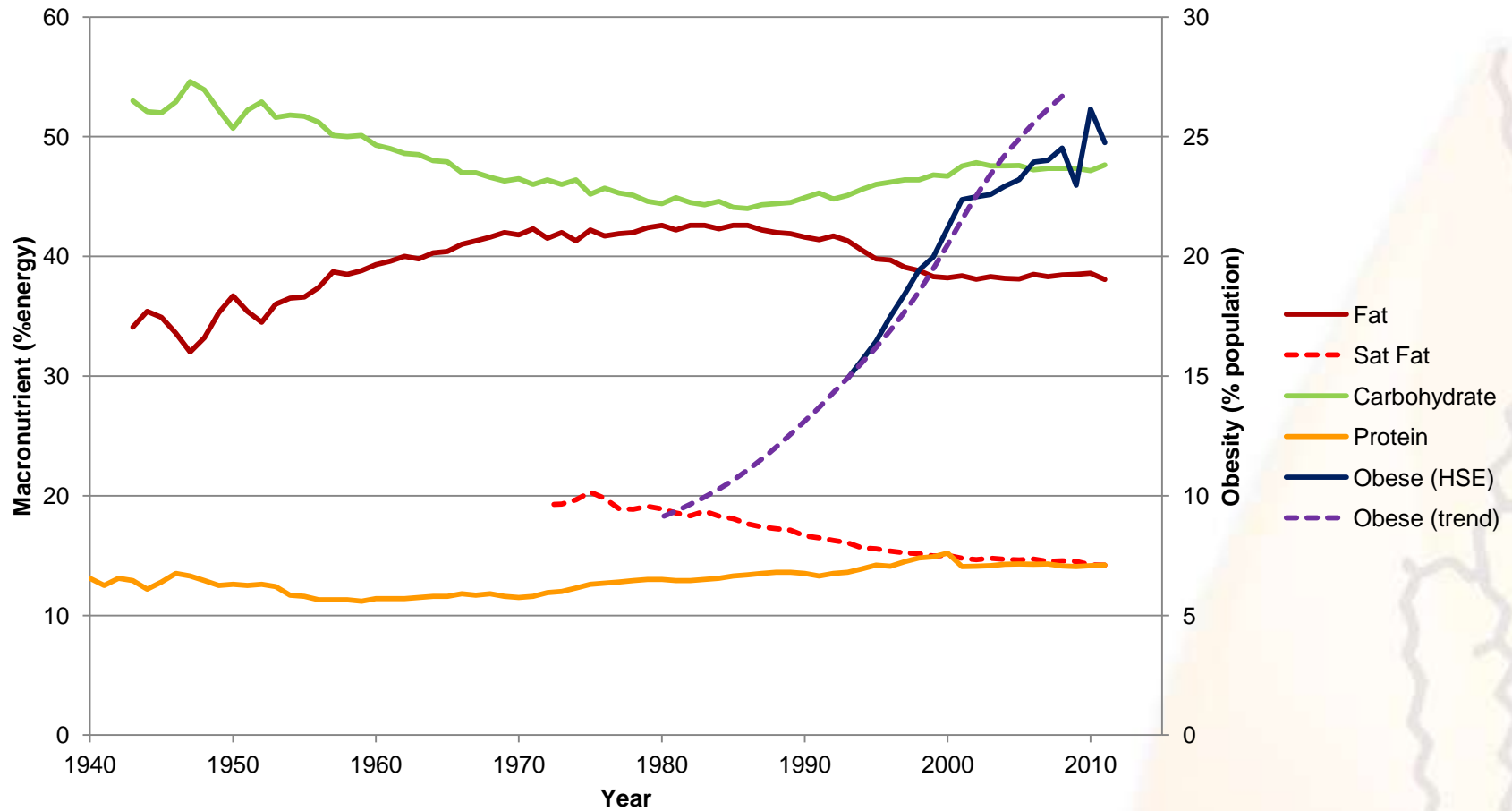
UK Dietary Recommendations

	Average % of food energy
Saturated fatty acids	≤ 11
Polyunsaturated fatty acids	6.5
Monounsaturated fatty acids	13
Trans fatty acids	≤ 2
<i>Total fat</i>	≤ 35
Non-milk extrinsic sugars	≤ 11
Intrinsic and milk sugars, and starch	39
<i>Total carbohydrate</i>	50
Fibre as non-starch polysaccharide (g/day)	18

Department of Health (1991) Dietary Reference Values for Food Energy and Nutrients in the United Kingdom. HMSO, London.



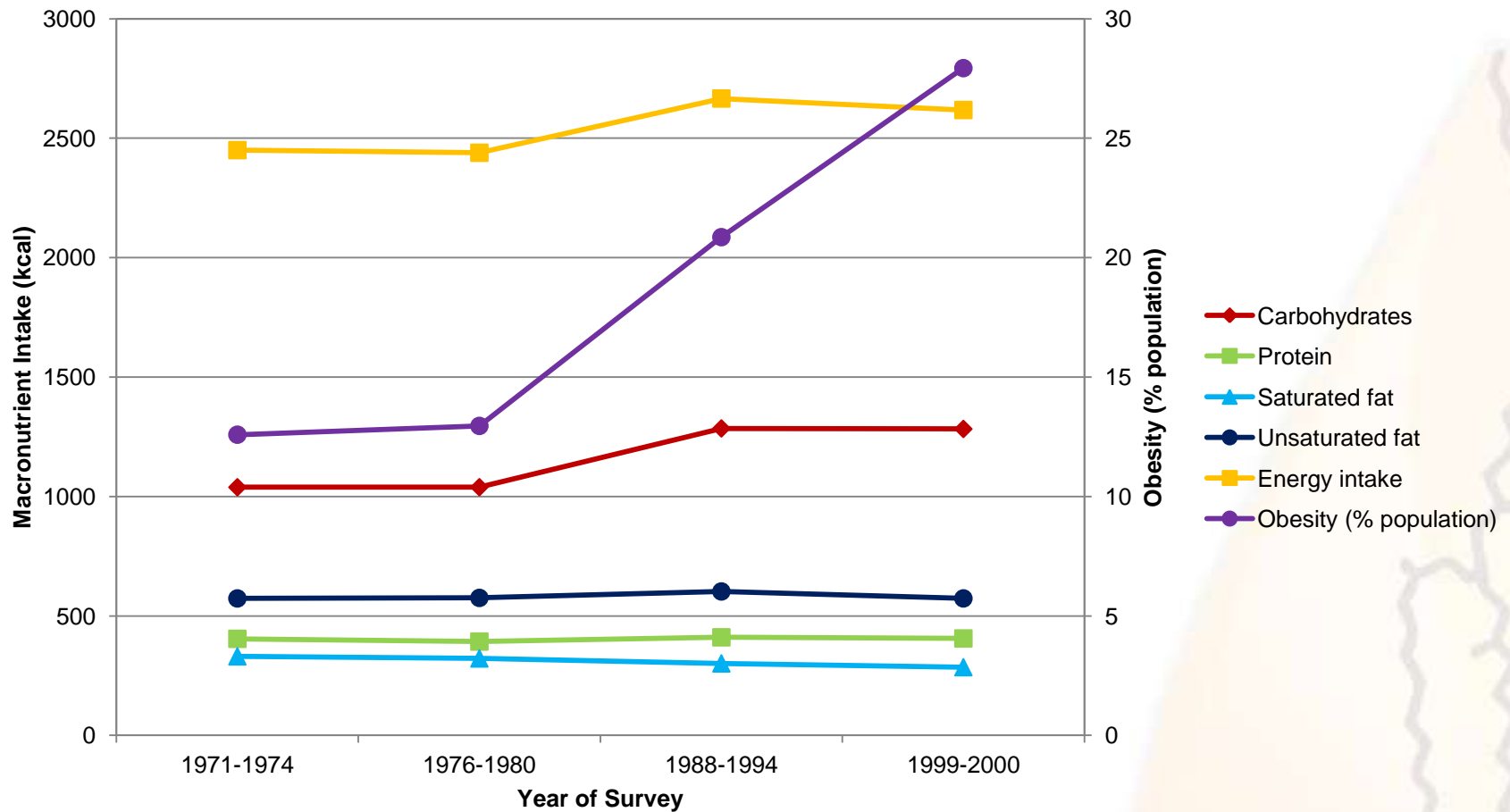
Trends in Obesity (UK)



DEFRA Family Food Surveys; NHS Statistics on Obesity, Physical Activity and Diet; Stevens et al. Population Health Metrics 2012, 10:22



Impact of Diet on Obesity (USA)



Source: US CDC, NHANES I, II, II & 1999-2000



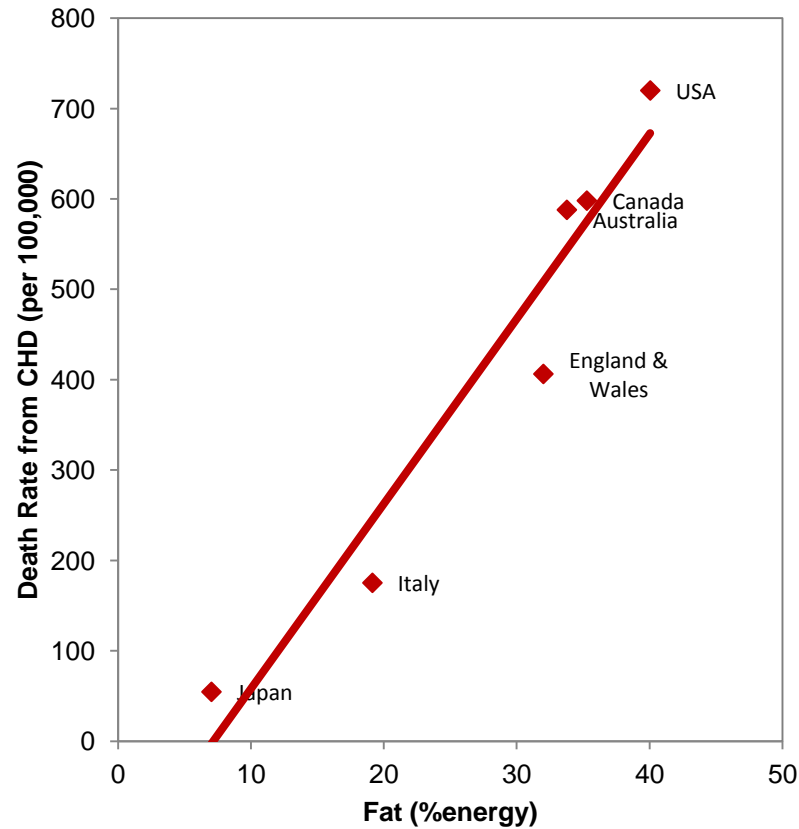
FAT & HEART DISEASE



Death Rate and Fat Intake

Death rate from CHD for men aged 55-59, 1948-1949

Keys



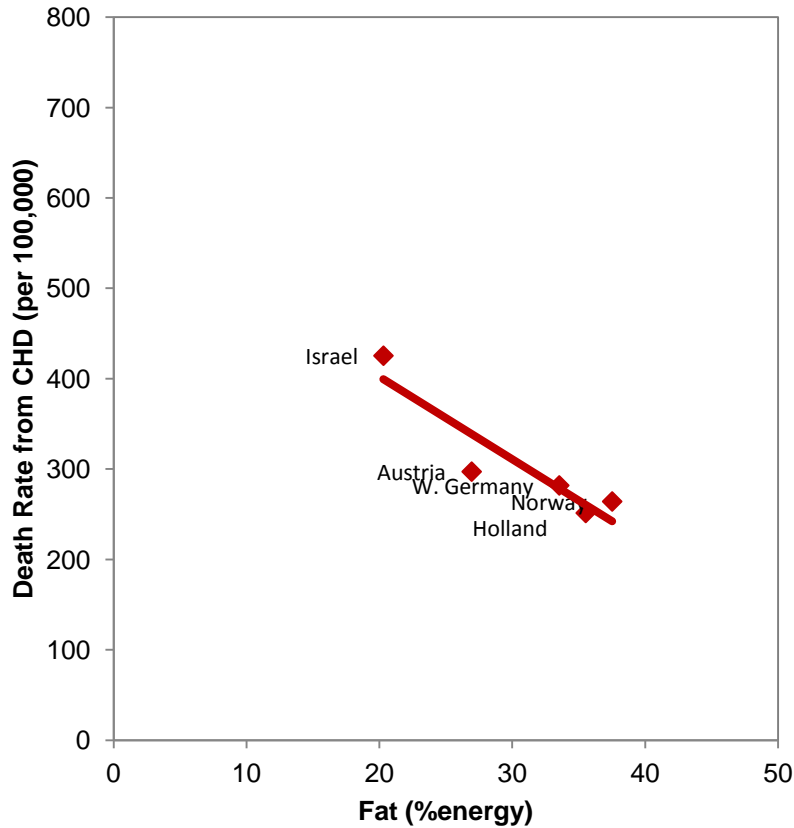
Keys A. J Mt Sinai Hosp NY 1953 20(2) 118-139



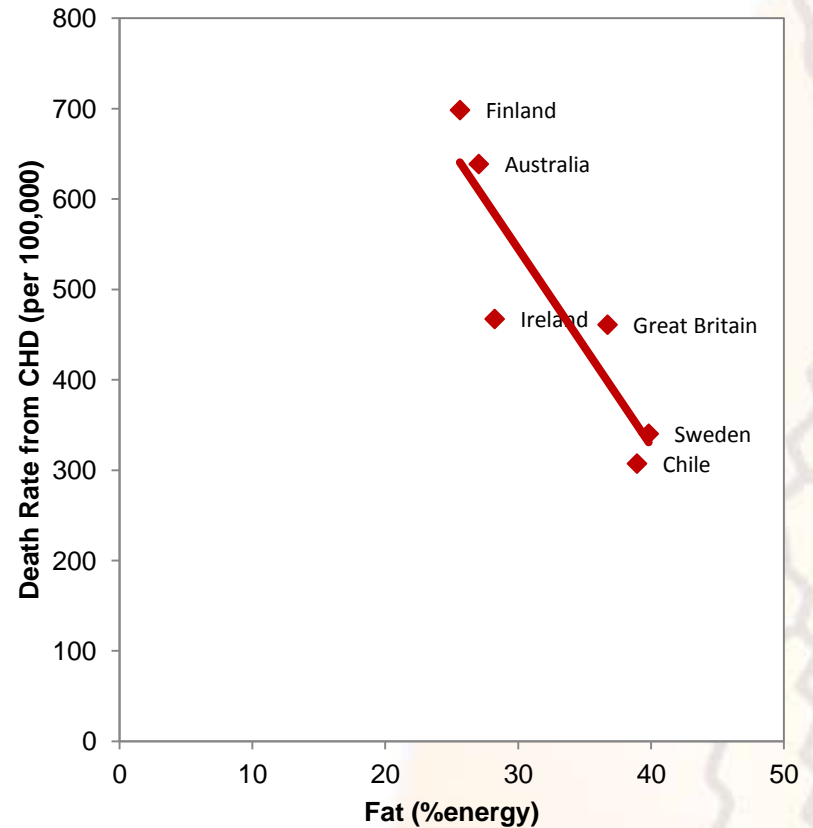
Death Rate and Fat Intake

Death rate from CHD for men aged 55-59, 1948-1949

Selection 1



Selection 2



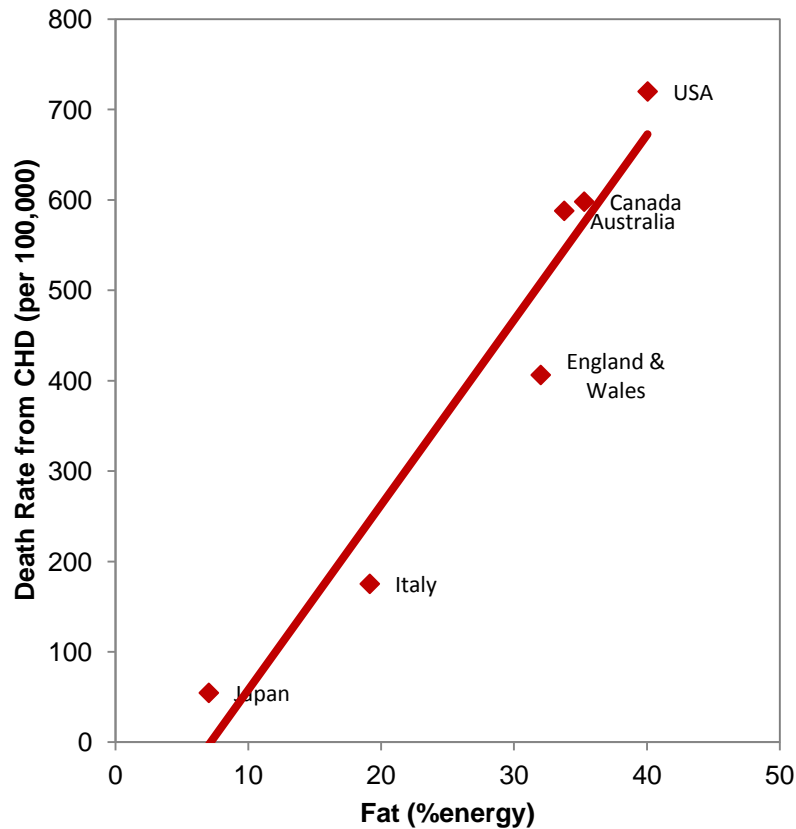
Data selected from Yerushalmi J, Hilleboe HE. NY State J Med 1957 57 2343-54



Death Rate and Fat Intake

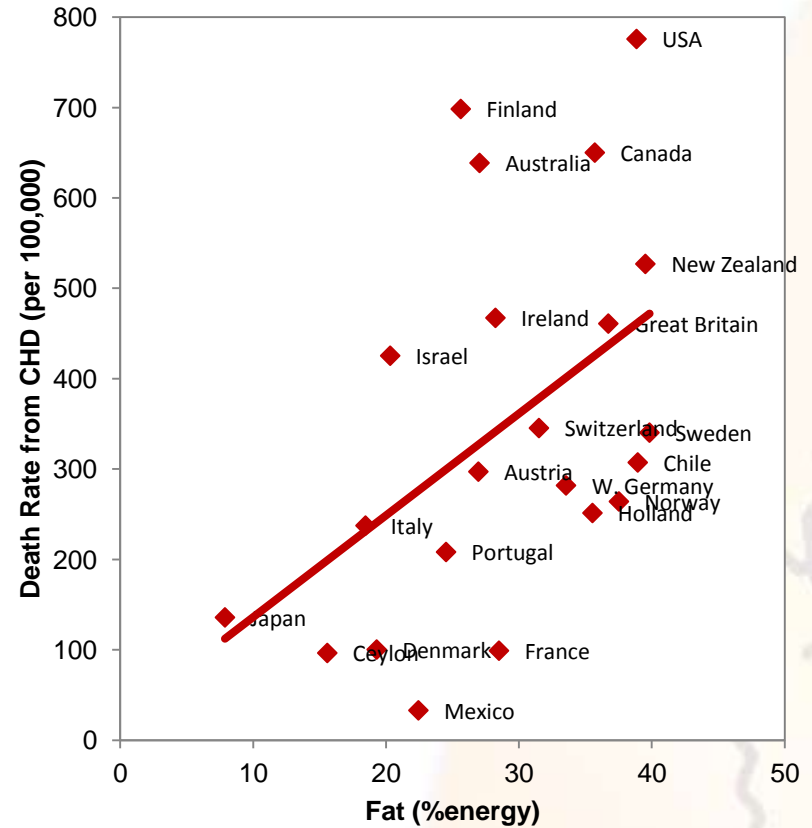
Death rate from CHD for men aged 55-59, 1948-1949

Keys



Keys A. J Mt Sinai Hosp NY 1953 20(2) 118-139

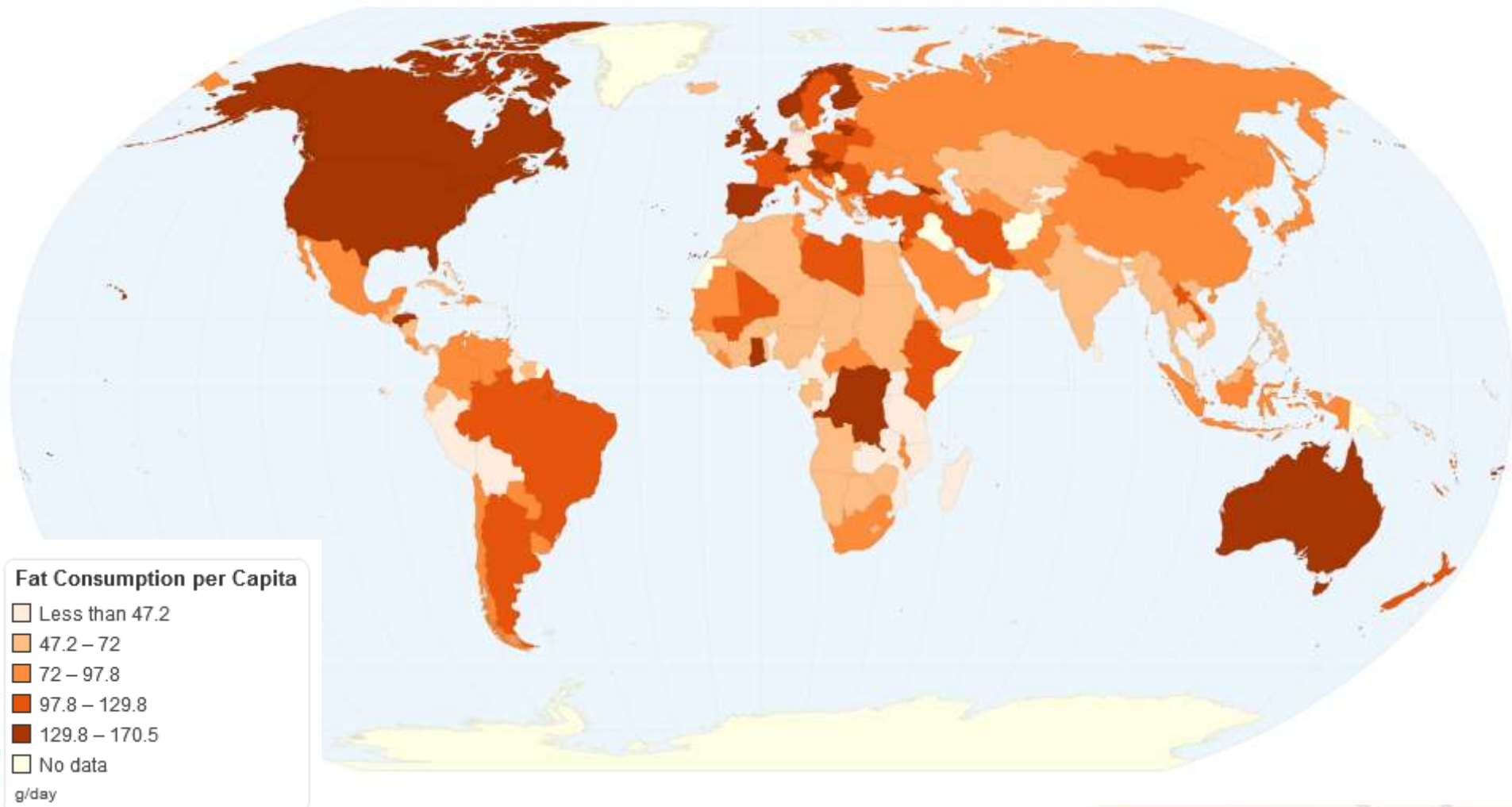
Yerushalmi & Hilleboe



Yerushalmi J, Hilleboe HE. NY State J Med 1957 57 2343-54



Fat Consumption per Capita



Food and Agriculture Organization of the United Nations, Statistics Division (faostat.fao.org)

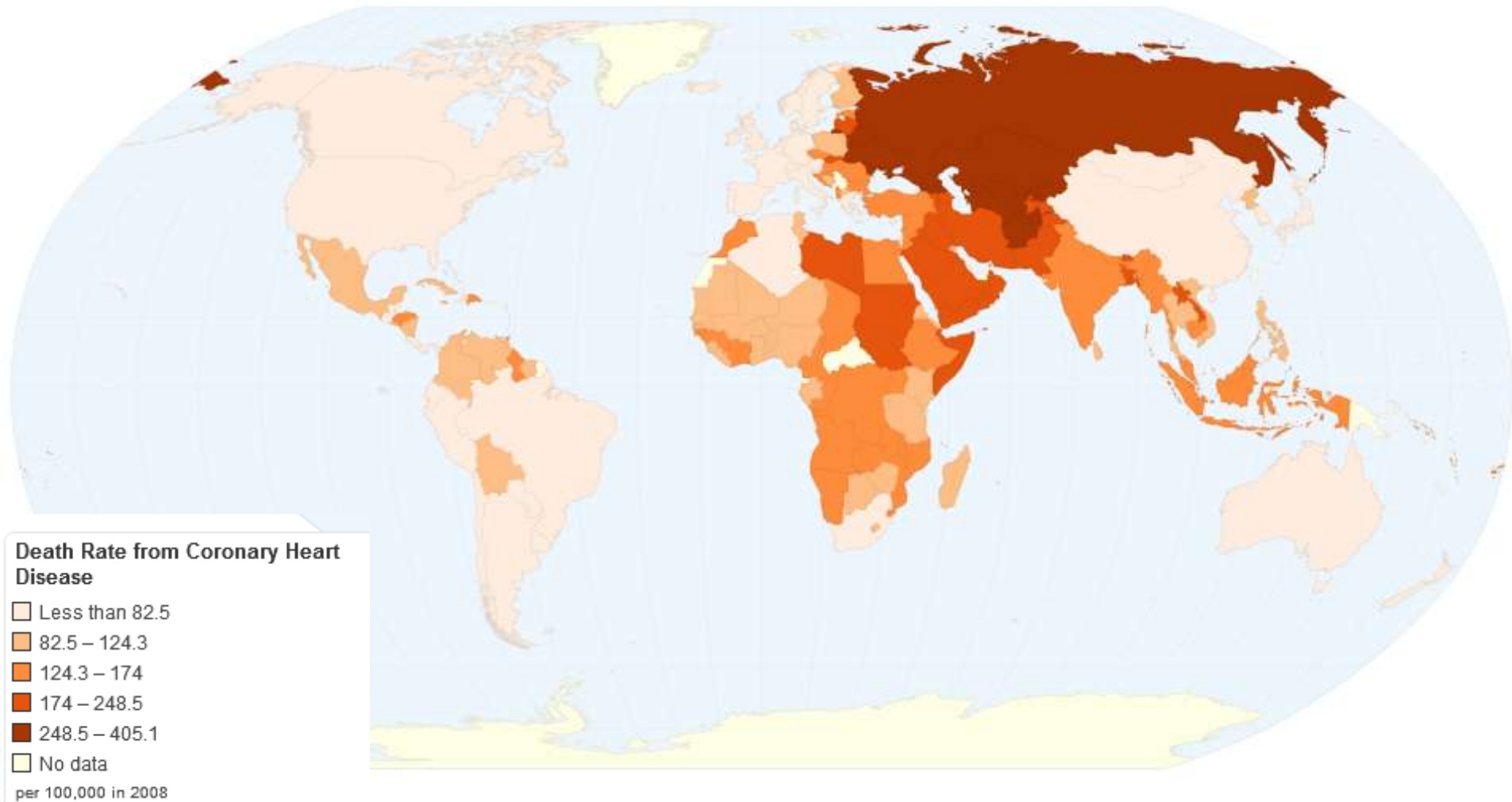


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Death From CHD



World Health Organization, World Health Statistics 2011



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FAT & CHOLESTEROL



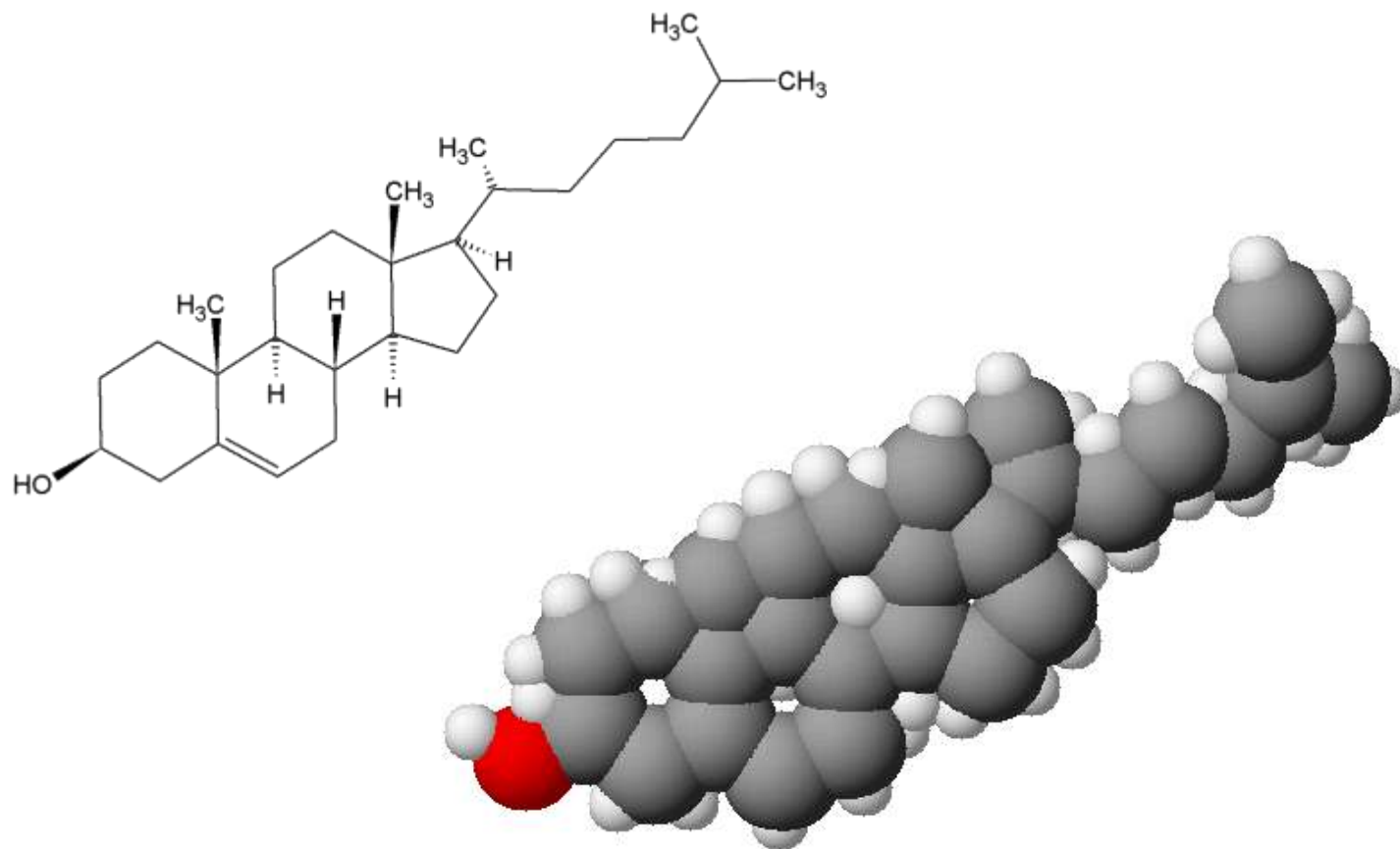
Diet – CHD Hypothesis

- 🔥 High SFA leads to high cholesterol
- 🔥 High cholesterol leads to high CHD rate
- 🔥 Hence high SFA leads to high CHD rate

- 🔥 Observations:
 - High SFA intake associated with high CHD rate per country
 - High cholesterol in individuals associated with high rates of CHD
 - Rationing (UK & Norway) was followed by reduction in heart disease
 - Arterial plaques contain cholesterol
 - Rabbits fed high cholesterol diet develop high blood cholesterol and atherosclerosis
 - Lowering cholesterol level with statins reduces rate of heart disease

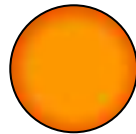


Cholesterol



Lipoproteins & Cholesterol

Chylomicron
(and remnant)
~1000nm



VLDL
27-200nm



IDL
23-27nm

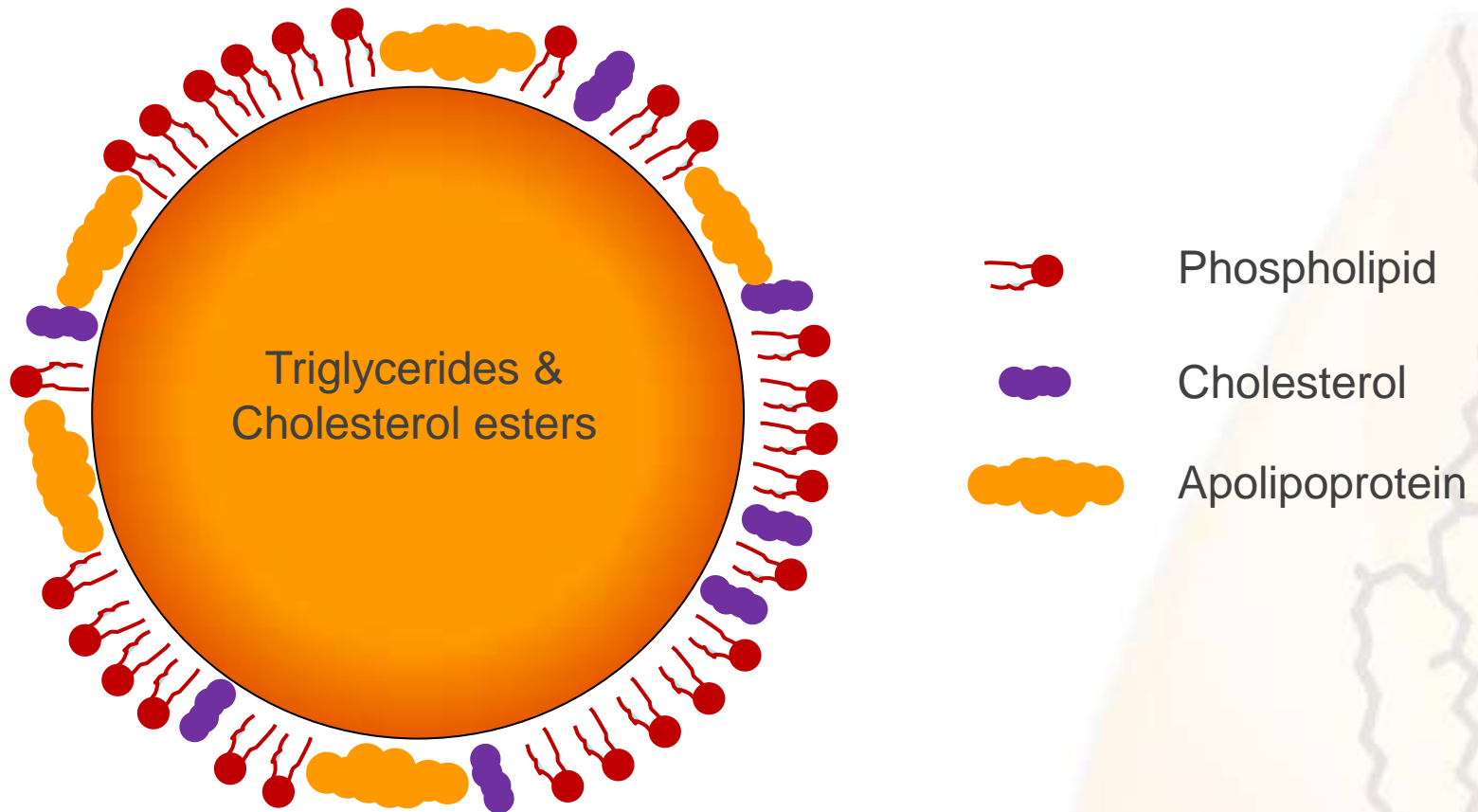


LDL
18-23nm



HDL
7-13nm

Lipoproteins & Cholesterol



Impact of Dietary Fat

- 🔥 Saturated fat: LDL ↑
- 🔥 Trans fat: LDL ↑ HDL ↓
- 🔥 Monounsaturated fat: LDL ↓
- 🔥 Polyunsaturated fat: LDL ↓ HDL ↑
 - omega 6 (n-6), mainly linoleic from vegetable oils
 - omega 3 (n-3), mainly EPA/DHA from fish oil but also linolenic from vegetable oil
- 🔥 Hence:
 - saturated fat = BAD
 - unsaturated fat = GOOD



HOW BAD IS SATURATED FAT?



Saturated Fat and Heart Disease

Lowest 4 consumers of Sat Fat

Country	Saturated Fat (%energy)	CHD Death Rate (per 100,000)
Georgia	5.2	148
Tajikistan	5.4	84
Azerbaijan	5.7	178
Moldova	5.8	120
Average	5.6	133

Highest 4 consumers of Sat Fat

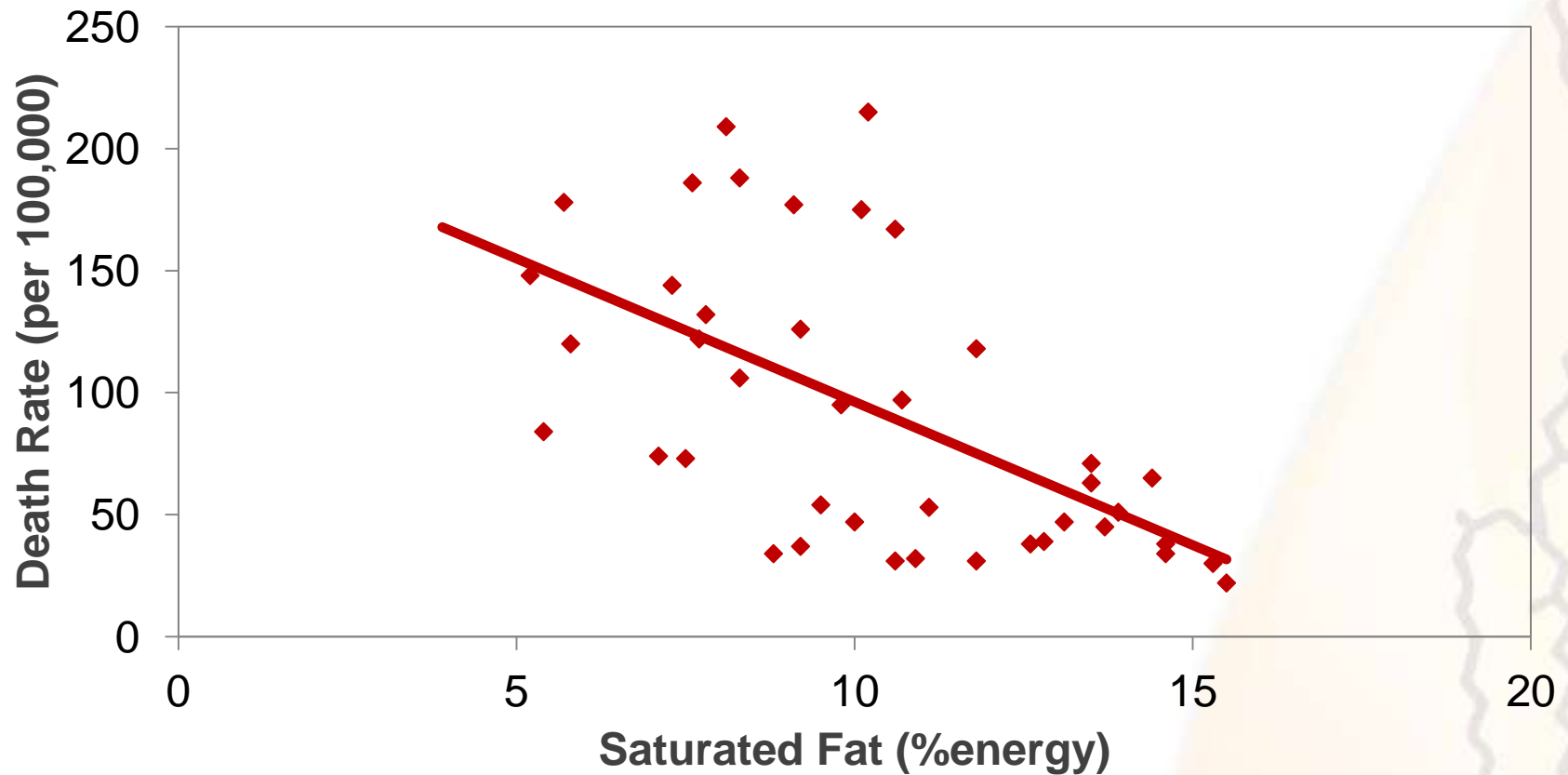
Country	Saturated Fat (%energy)	CHD Death Rate (per 100,000)
Iceland	14.6	34
Netherlands	14.6	38
Switzerland	15.3	30
France	15.5	22
Average	15	31

CHD death rate for men 1998. European Cardiovascular Disease Statistics, 2008 Edition



Death Rate and Sat Fat Intake

European Cardiovascular Disease Statistics, 2008 Edition



Age standardised death rate from CHD for men in 1998



Saturated Fat Not So Bad

- 🔥 During 5-23 year of follow-up of 347,747 subjects, 11,006 developed CVD or stroke. Intake of **saturated fat was not associated with an increased risk of CHD**, stroke or CVD. Consideration of age, sex and study quality did not change the results.

Siri-Tarino et al., *Am J Clin Nutr* 2010; 91: 535-546.



Framingham Heart Study

- “Since our beginning in 1948, the Framingham Heart Study, under the direction of the National Heart, Lung and Blood Institute (NHLBI), formerly known as the National Heart Institute, has been committed to identifying the common factors or characteristics that contribute to cardiovascular disease (CVD). We have followed CVD development over a long period of time in three generations of participants.”
- “Our Study began in 1948 by recruiting an *Original Cohort* of 5,209 men and women between the ages of 30 and 62 from the town of Framingham, Massachusetts, who had not yet developed overt symptoms of cardiovascular disease or suffered a heart attack or stroke. Since that time the Study has added an *Offspring Cohort* in 1971, the *Omni Cohort* in 1994, a *Third Generation Cohort* in 2002, a *New Offspring Spouse Cohort* in 2003, and a *Second Generation Omni Cohort* in 2003.”



How Bad is Saturated Fat?

- “...the **more saturated** fat one ate, the **more cholesterol** one ate, the **more calories** one ate, the **lower** the person's **serum cholesterol**.”
“...the people who ate the most **cholesterol**, ate the most **saturated fat**, ate the **most calories**, **weighed the least**, and were the **most physically active**.”

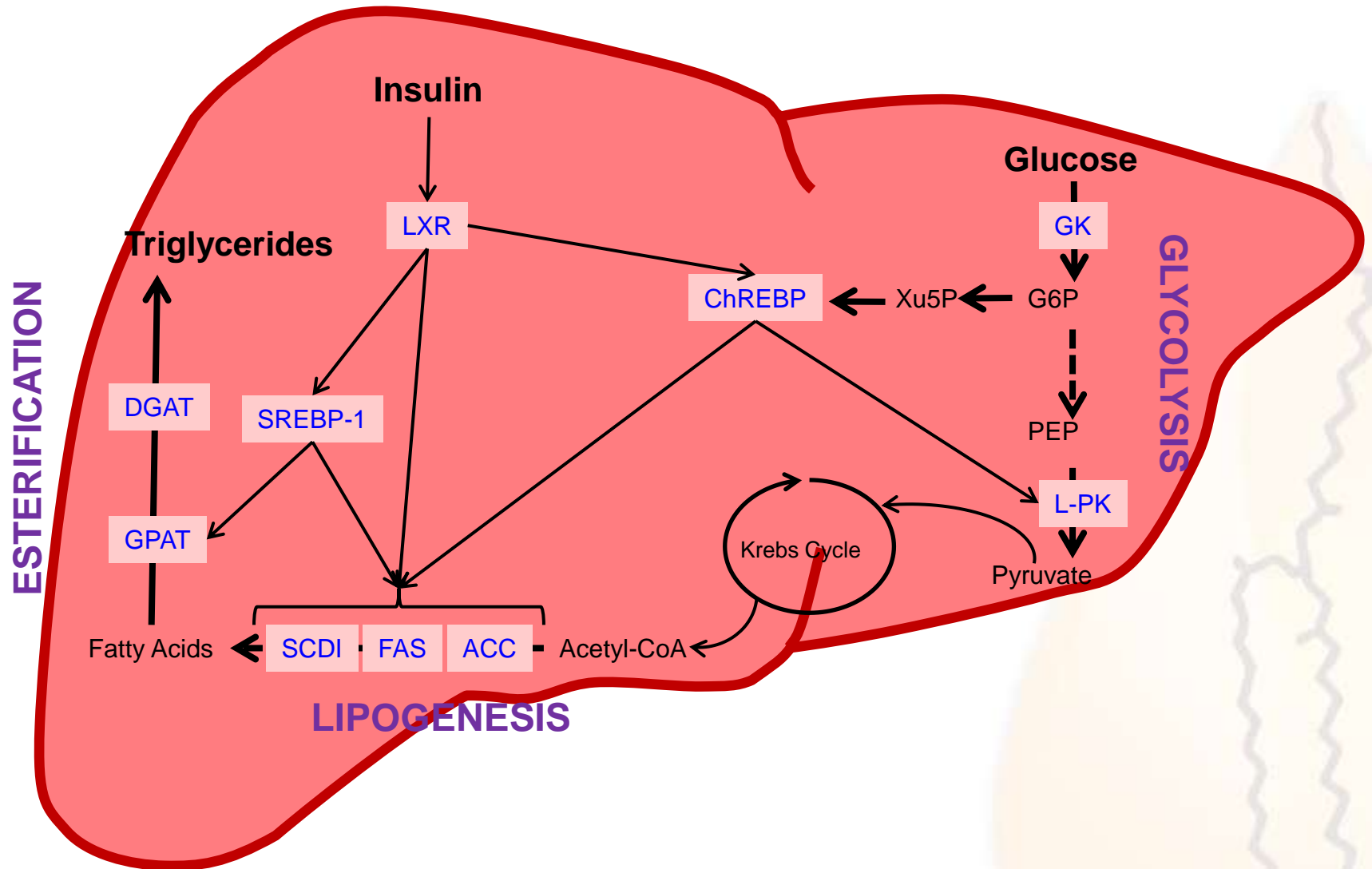
William P. Castelli (Framingham Heart Study), Arh Int Med 1992 152(7) 1371-1372

- “...dietary saturated fatty acids are not associated with [coronary artery disease] and other adverse health effects...”
“The adverse health effects that have been associated with saturated fats in the past are most likely due to factors other than SFAs...”

Glen D. Lawrence (Dept. Chem & Biochem, Long Island University), Adv Nutr 2013 4(3) 294-302



Formation of Fat in the Body



Saturated Fat in the Body

- Human body fat contains around 25-33% saturates (not much different to lard).
- Of the fatty acids in cell membranes, 50% are saturated, giving membranes stiffness and integrity.
- Stearic and palmitic acids are the preferred fuel for the heart; the fat around the heart is >40% saturated.¹
- Saturated fat decreases lipoprotein(a) [LP(a)], which is a risk factor for heart disease.²
- Saturated fats enhance immune system function.³
- Saturated fats are necessary for proper retention and use of essential fatty acids.⁴
- Note: only around 26% of the fat in arterial plaques is saturated, the rest being unsaturated (at least half of which is polyunsaturated).⁵

¹ Calder et al. Lipids 1992 27(9) 716-720

² Dahlen et al, J Intern Med 1998 244(5) 417-424; Khosla et al. J Am Coll Nutr 1996 15 325-339; Clevidence et al. Atheroscler Thromb Vasc Biol 1997 17 1657-1661

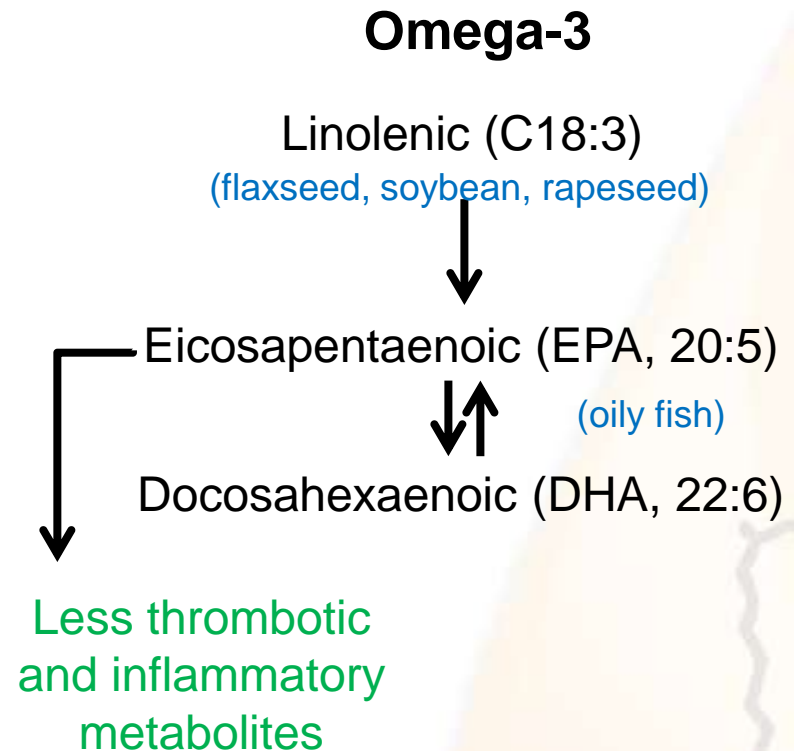
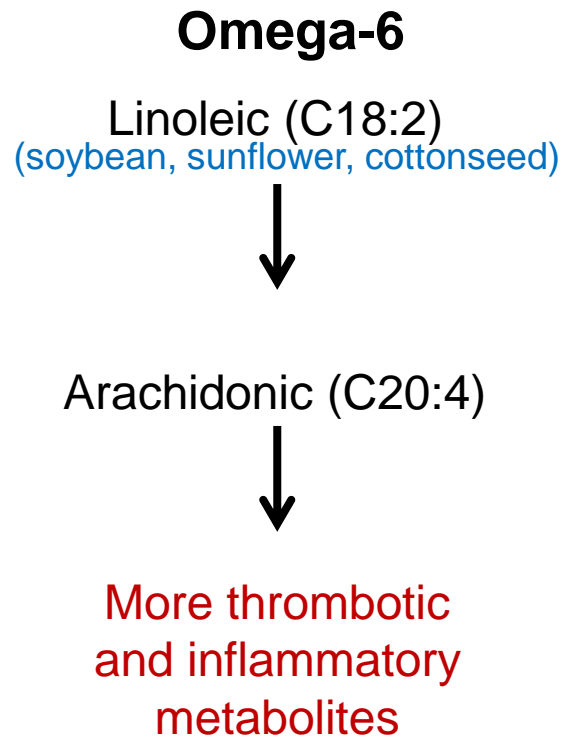
³ Cohen et al. J Natl Cancer Inst 1986 77(1) 43-51

⁴ Garg et al. FASEB Journal 1988 2(4) A852; Oliart Ros et al. "Meeting Abstracts" AOCs Proceedings, May 1998, 7, Chicago, IL

⁵ Felton et al. Lancet 1994 344 1195-1196



Fate of Essential Fatty Acids



Polyunsaturated Fat in the Body

- There is an upper limit of around 6% energy for optimum function and should be dominated by omega-6 (ratio about 6:1 or more).¹
- Excess consumption leads to increased risk of many diseases: cancer, heart disease, immune system dysfunction, damage to liver, reproductive organs and lungs, digestive disorders, depressed learning ability, impaired growth, weight gain.²
- If omega-6 is too high, production of important prostaglandins can be inhibited; among other things, leads to greater risk of blood clots, inflammation, high blood pressure.³
- If omega-3 is too low, there can be risk of asthma, heart disease and learning deficiencies.⁴

¹ Lasserre et al Lipids 1992 27(9) 227-233

² Pinckney et al. The Cholesterol Controversy 1973, Sherbourne Press, Los Angeles, 127-131; Harmon et al J Am Geriatrics Soc 1976 24(1) 292-298; Meerson et al. Bull Exp Bio Med 1983 96(9) 70-71; Valero et al. Ann Nutr Metabolism 1990 34(6) 323-327; Felton et al. Lancet 1994 344 1195-1196

³ Kinsella, J.E. Food Technol, Oct 1988, 134; Lasserre et al Lipids 1992 27(9) 227-233; Horrobin D.F. Rev Pure Appl Pharmacol Sci 1983 4(4) 339-83

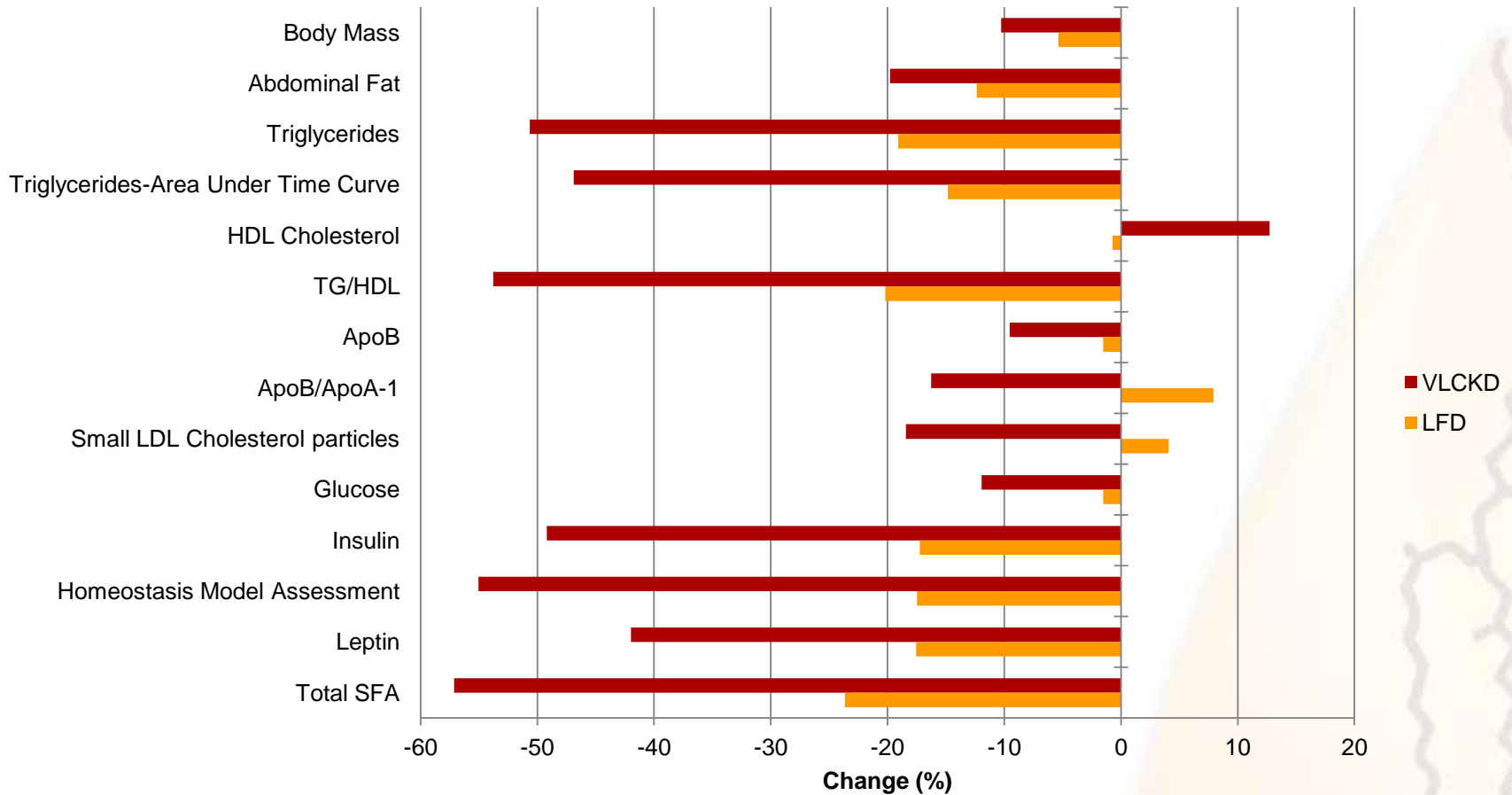
⁴ Okuyama et al. Prog Lipid Res 1996 35(4) 409-457



CAN FAT BE GOOD?



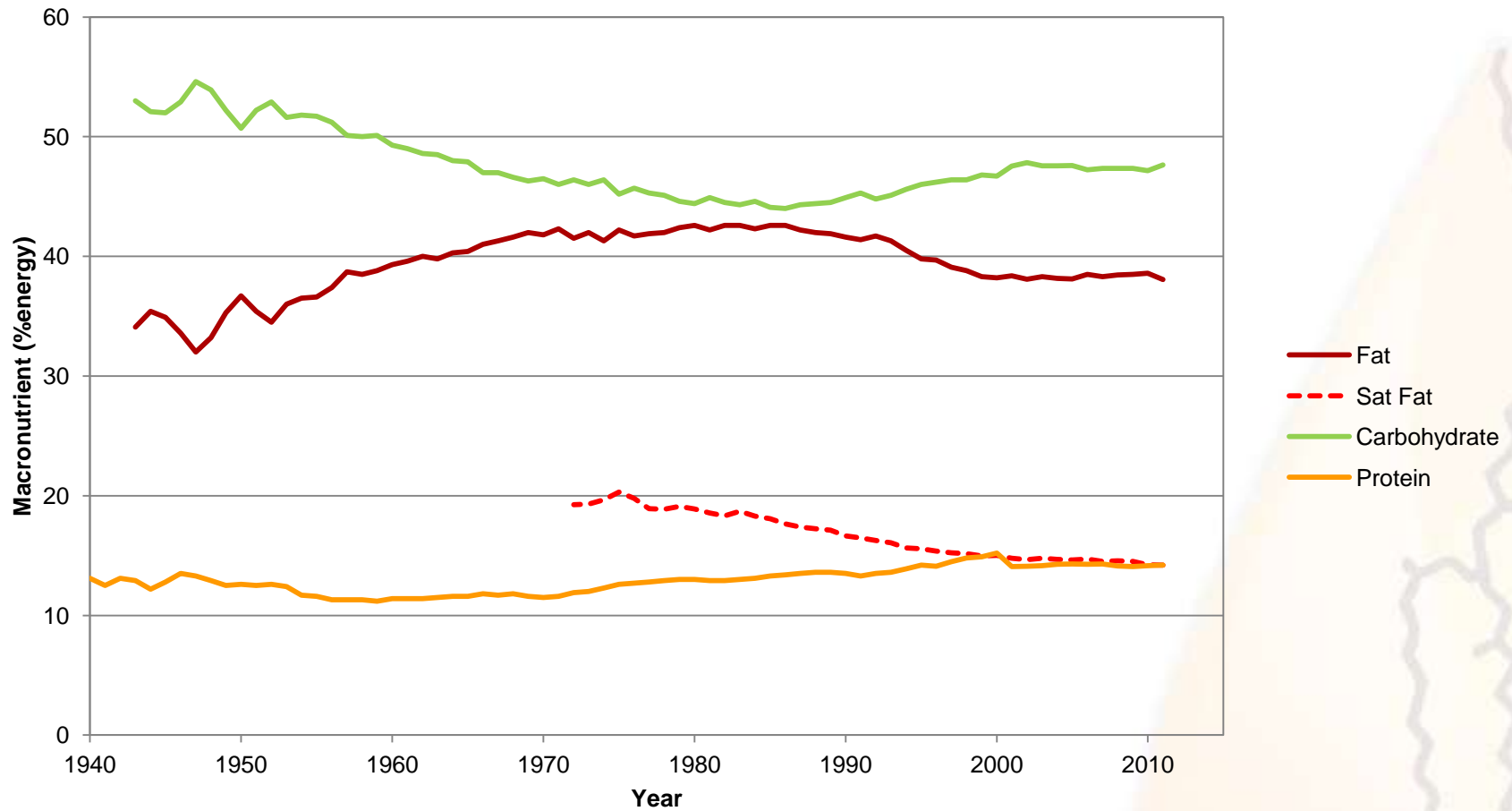
High Fat Diet Reverses Coronary Risk Factors



Volek, et al. Prog Lipid Res 2008; 47: 307-318

VLCKD CHO:Fat:Protein 12:59:28 1504 kcal
LFD: CHO:Fat:Protein 56:24:20 1478 kcal

Trends in Diet (UK)



DEFRA Family Food Surveys



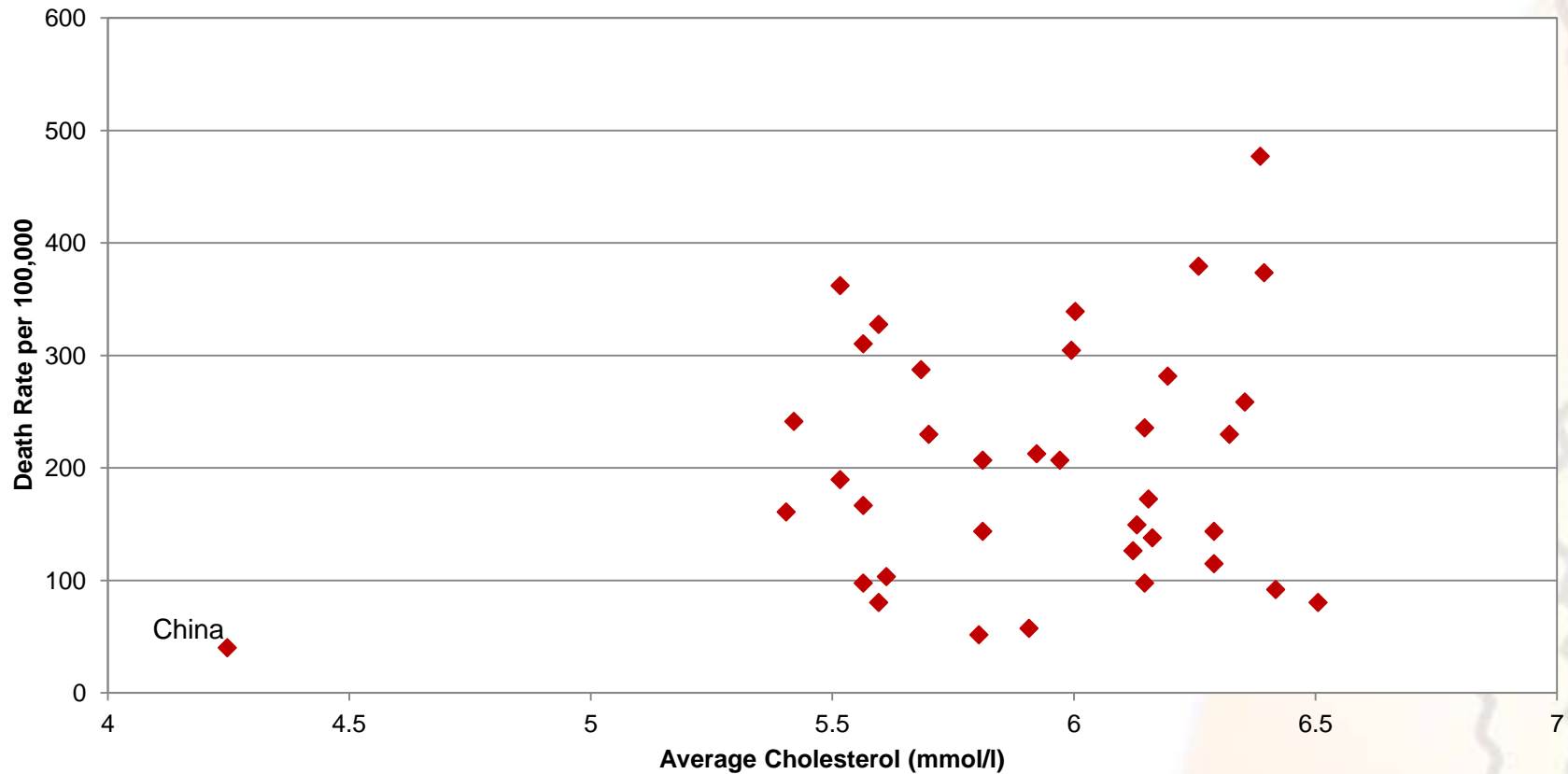
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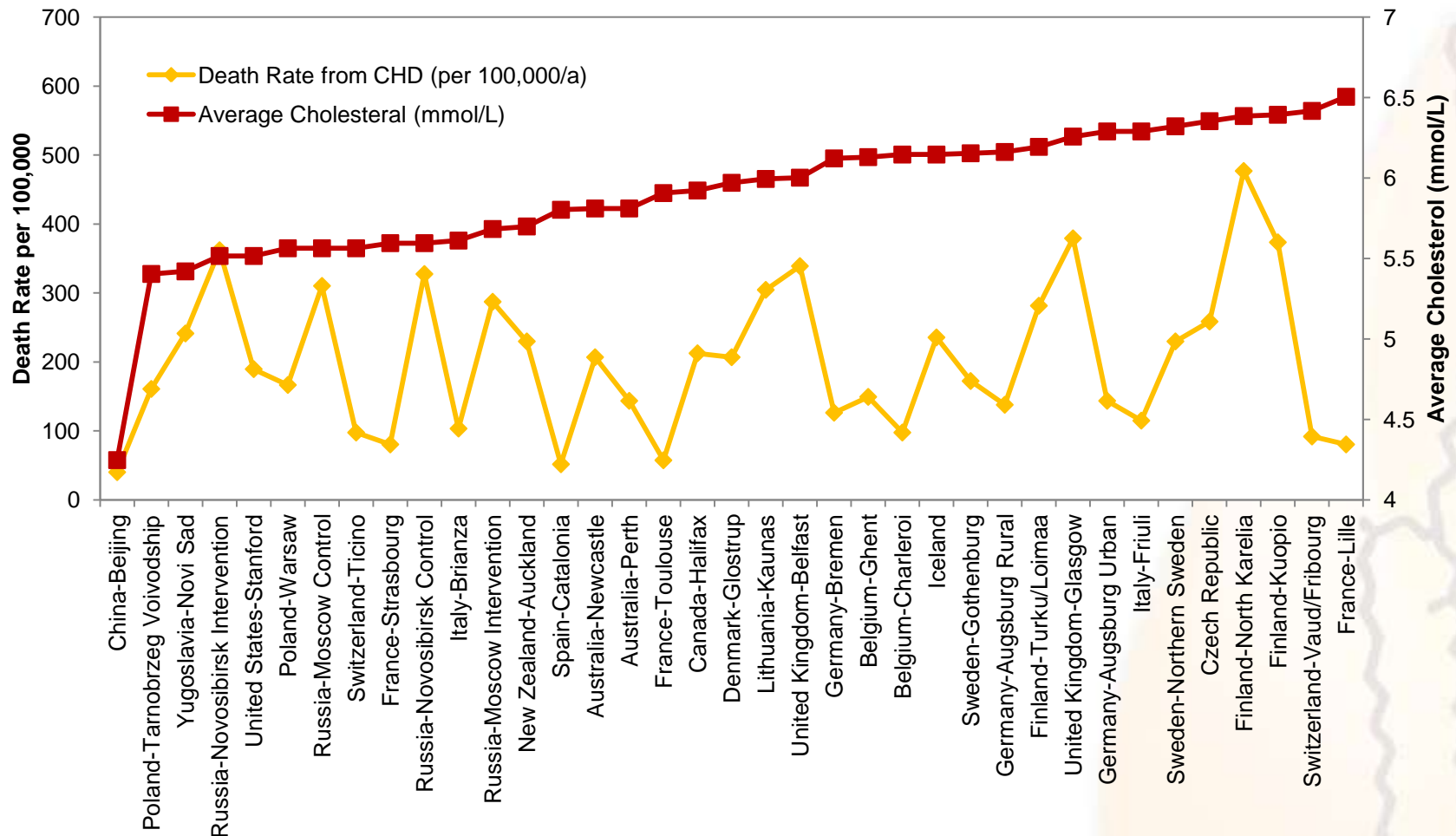
WHO MONICA Project 1979-2002

Men aged 35-64



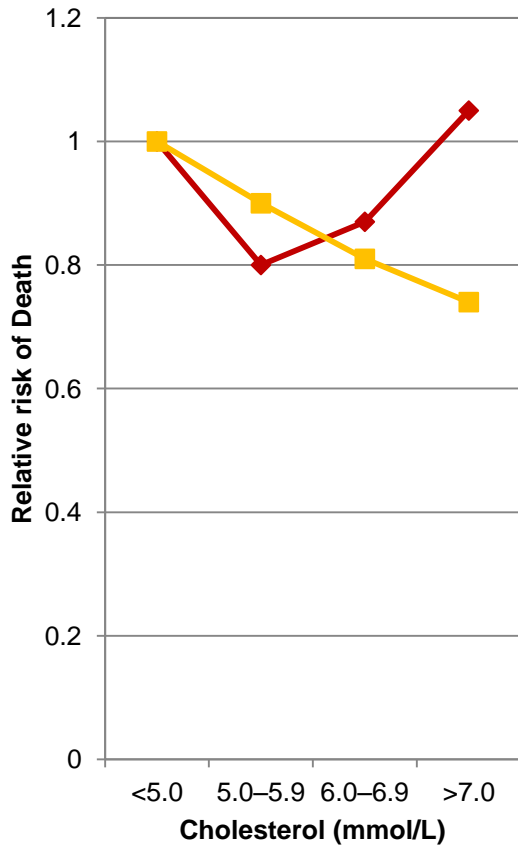
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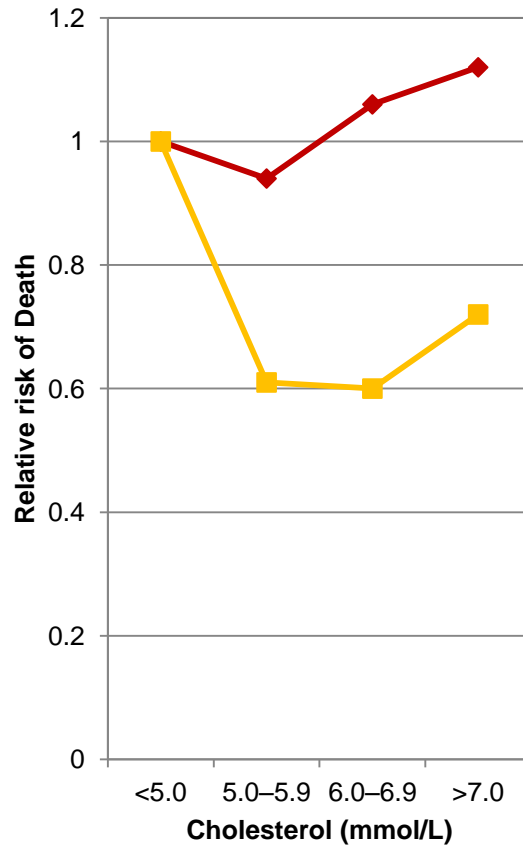


Ideal Cholesterol Level?

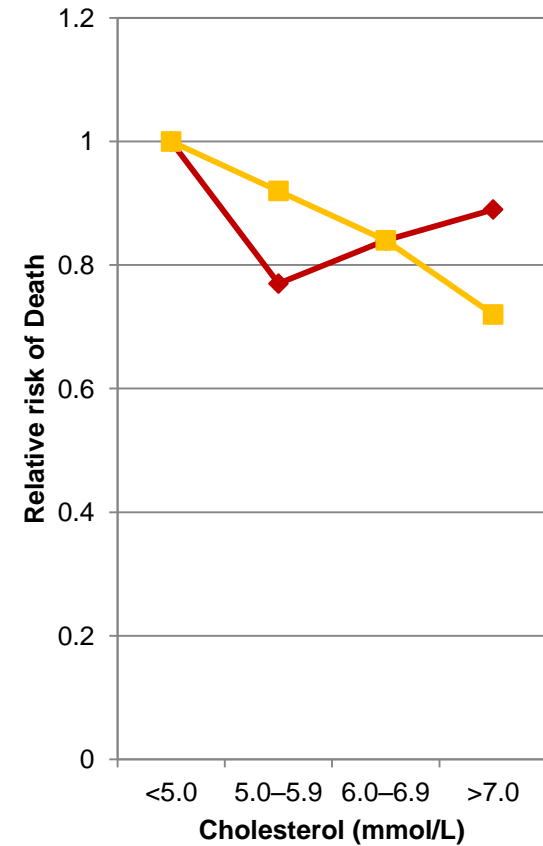
Cardiovascular Disease



Ischaemic Heart Disease



Any cause

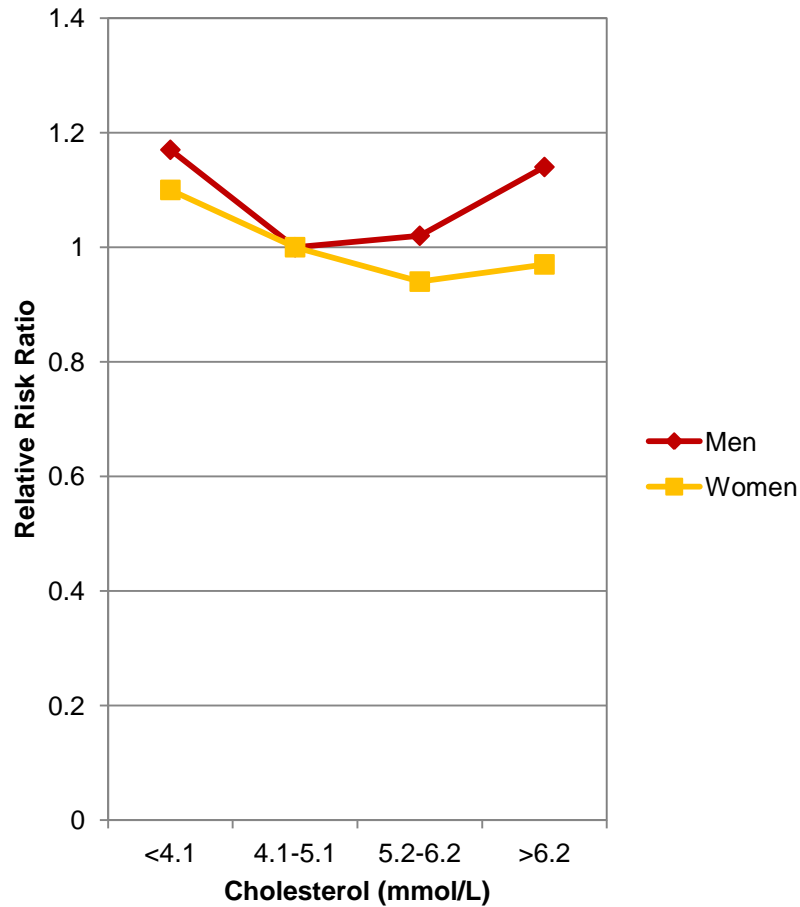


Men
Women

HUNT2 study: Petursson, et al. J Eval Clin Prac 2012, 18, 159-168



Ideal Cholesterol Level?



Conference on low cholesterol: Jacobs, et al. Circulation 1992, 86, 1046-1060



Honolulu Heart Program

- 🔥 A generally held belief is that cholesterol concentrations should be kept low to lessen the risk of cardiovascular disease. However, studies of the relation between serum cholesterol and all-cause mortality in elderly people have shown contrasting results. To investigate these discrepancies, we did a longitudinal assessment of changes in both lipid and serum cholesterol concentrations over 20 years, and compared them with mortality.
- 🔥 Mean cholesterol fell significantly with increasing age. Age-adjusted mortality rates were 68.3, 48.9, 41.1, and 43.3 for the first to fourth quartiles of cholesterol concentrations, respectively. Only the group with **low cholesterol** concentration at both examinations had a **significant association with mortality**.

Honolulu Heart Program. Schatz, et al. Lancet 2001 358, 351-355



Dangers of Low Cholesterol

- 🔥 We have been unable to explain our results. These data **cast doubt** on the **scientific justification for lowering cholesterol** to very low concentrations (<4.65 mmol/L) in elderly people.
- 🔥 Although our results lend support to previous findings that low serum cholesterol imparts a poor outlook when compared with higher concentrations of cholesterol in elderly people, our data also suggest that those individuals with a low serum cholesterol maintained over a 20-year period will have the worst outlook for all-cause mortality.

Honolulu Heart Program. Schatz, et al. Lancet 2001 358, 351-355



Dangers of Low Cholesterol

- 🔥 In men, across the entire age range, although of borderline significance under the age of 50, and in women from the age of 50 onward only, **low cholesterol was significantly associated with all-cause mortality**, showing significant associations with death through cancer, liver diseases, and mental diseases.

Ulmer, et al. J Women's Health 2004 13(1) 41-53

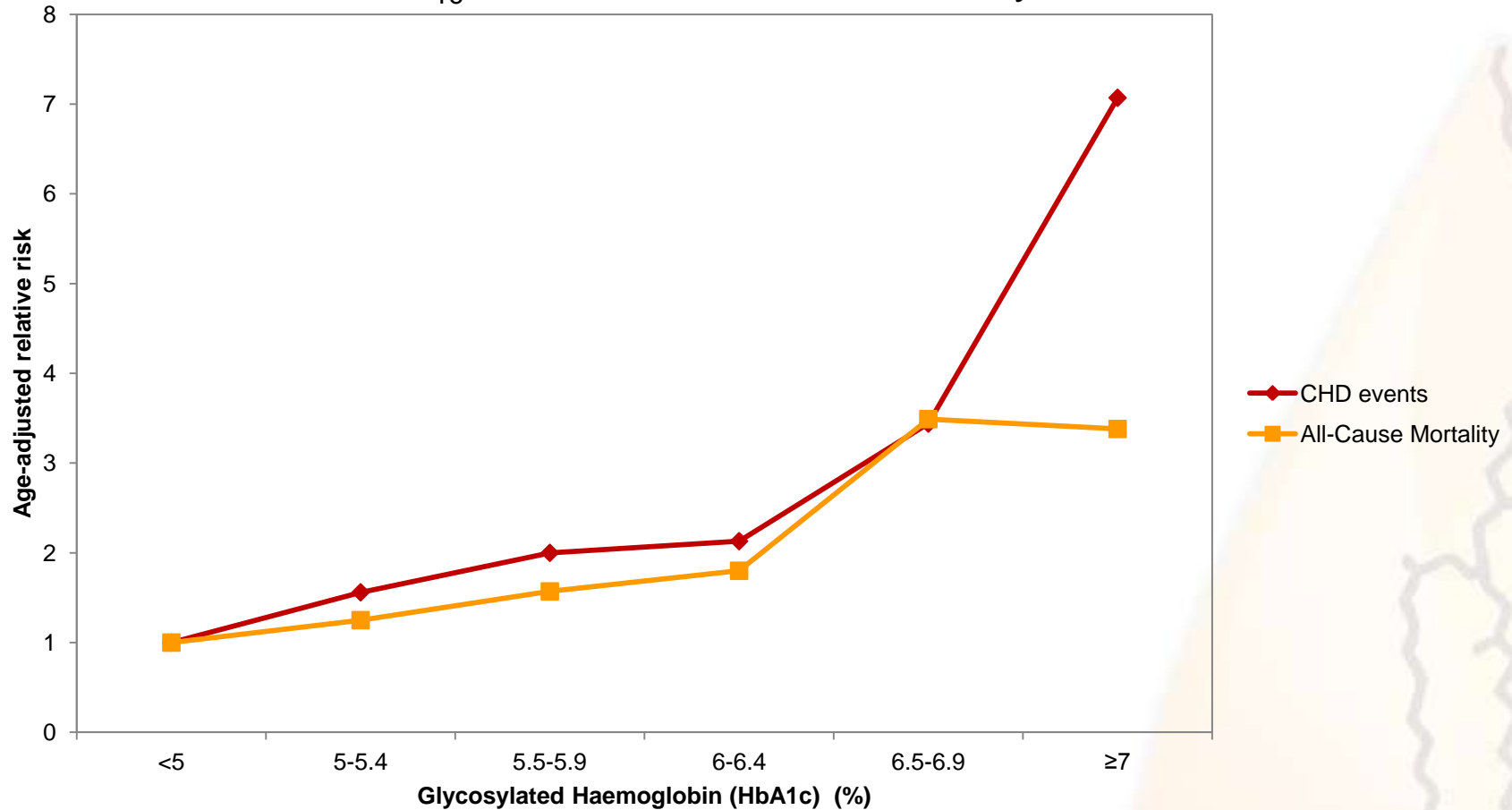


FINAL REMARKS



Other Risk Factors for Mortality

HbA_{1c} , CHD and All-cause Mortality



Khaw et al. Ann Intern Med 2004; 141: 413-420



View from the Cochrane Collaboration

Reduced or modified dietary fat for preventing cardiovascular disease (Review)

Hooper L, Summerbell CD, Thompson R, Sills D, Roberts FG, Moore HJ, Davey Smith G



This is a reprint of a Cochrane review, prepared and maintained by The Cochrane Collaboration and published in *The Cochrane Library* 2012, Issue 5

<http://www.thecochranelibrary.com>



Reduced or modified dietary fat for preventing cardiovascular disease (Review)
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Main Findings:

There were **no clear effects of dietary fat changes on total mortality** (RR 0.98, 95% CI 0.93 to 1.04, 71,790 participants) **or cardiovascular mortality** (RR 0.94, 95% CI 0.85 to 1.04, 65,978 participants).



Where Do We Go From Here?

- 🔥 It seems apparent that doubt has been cast on the 'Diet-Heart Hypothesis'
- 🔥 Scientists challenging the long-held beliefs about fat, saturated fat, cholesterol & cardiovascular disease are swimming against the tide.
- 🔥 Fat may not be a problem, nor saturated fat.
- 🔥 Must follow current recommendations but...
- 🔥 Watch this space!



For Further Reading

- 🔥 Ravenskov U. “A hypothesis out-of-date: The diet–heart idea.” *J Clin Epidemiol* 2002 55 1057–1063
- 🔥 Malcolm Kendrick - *The Great Cholesterol Con*
- 🔥 Ben Goldacre - *Bad Science*
- 🔥 The International Network of Cholesterol Skeptics - www.thincs.org

- 🔥 Also, look out for the following authors:
 - Mary Enig
 - Sally Fallon
 - Duane Graveline
 - Chris Masterjohn
 - Tim Noakes
 - Anthony Colpo
 - Gary Taubes
 - Jonny Bowden & Stephen Sinatra





There is nothing better than a friend, unless it is a friend with chocolate!
Linda Grayson (Printwick Papers)



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