Do Saturated Fats Cause Chronic Metabolic Diseases?

Ronald P. Mensink

Department of Nutrition and Movement Sciences

NUTRIM, School for Nutrition and Translational Research in Metabolism

Maastricht University

Maastricht

The Netherlands

Maastricht University

NUTRIM

PHuN
Physiology of Human Nutrition

Research Funding

- Netherlands Organisation for Scientific Research
- Dutch Top Sector Life Sciences and Health
- Dutch Top Sector Agri & Food
- Alpro Foundation
- Unilever R&D, Vlaardingen
- Upfield

Committees

- Dutch Health Council
- Standing Committee on Healthy Nutrition of the Dutch Health Council
- Scientific advisor ILSI-Europe Task Force “Qualitive Fat Intake”
- Expert group member (ILSI):
  - Update Update on Health Effects of Different Dietary Saturated Fats
  - Establishment of the Efficacy of Intervention in those with the Metabolic Syndrome
  - Omega-3 and Omega-6 PUFA Intakes, Ratios and Health Effects
- Scientific Committee Healthy Choices Logo
- Wetenschappelijke Adviescommissie Akkoord verbetering productsamenstelling

Chronic Metabolic Diseases

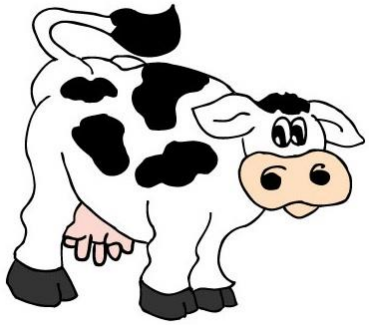
- Metabolic syndrome
- Cardiovascular diseases
- Dyslipidemia
- Type 2 diabetes
- Hypertension
- Obesity
- Non-alcoholic fatty liver disease (NAFLD)
- ……

Chronic Metabolic Diseases

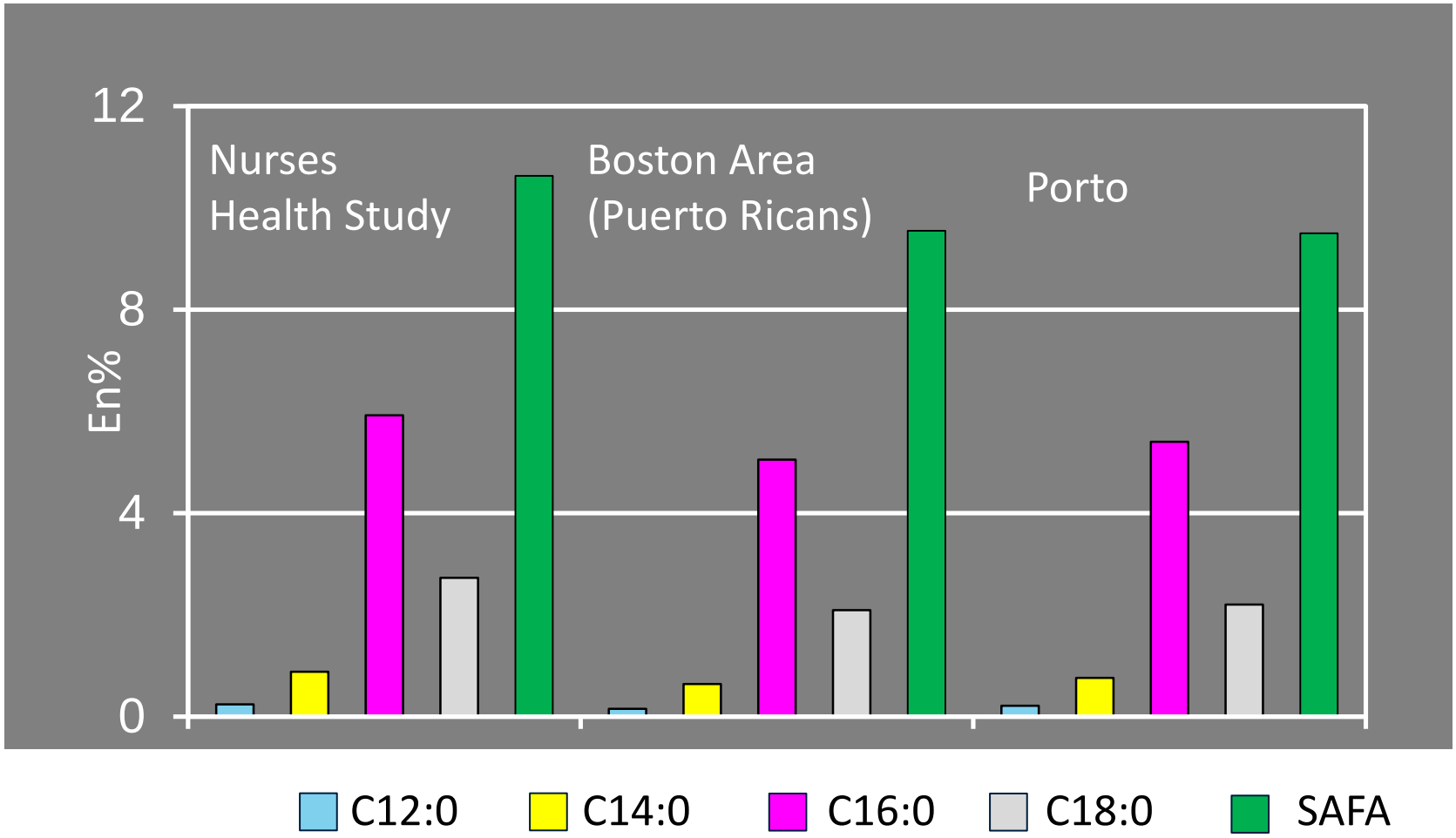
- Metabolic syndrome
- Cardiovascular diseases
- Dyslipidemia
- Type 2 diabetes
- Hypertension
- Obesity
- Non-alcoholic fatty liver disease (NAFLD)
- ……

Some Facts on Saturated Fatty Acids

- Present in all foods
- Intakes are in general poorly reflected by body lipid pools
  → exception: C15:0 and C17:0
- De novo synthesis
- Are not one single compound
  - MCT
  - Lauric acid
  - Myristic acid
  - Palmitic acid
  - Stearic acid

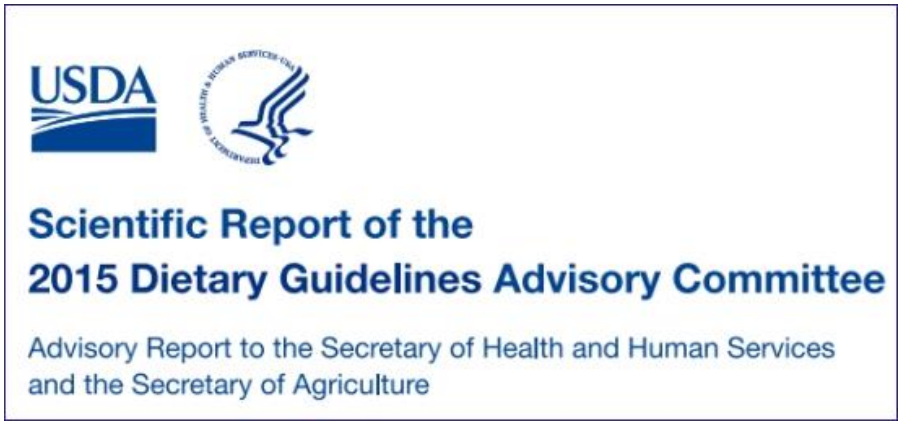


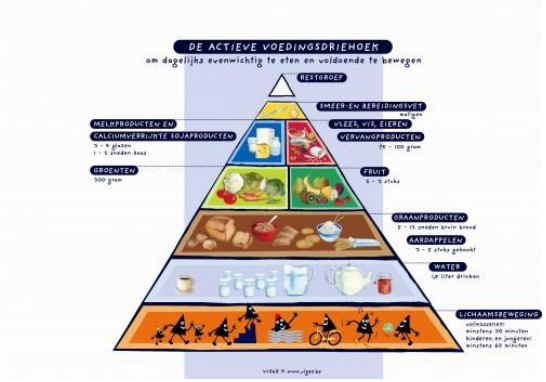
Intakes of Saturated Fatty Acids in Western Countries



Hu FB et al. Am J Clin Nutr, 1999; Smith CE et al. Obesity, 2013; Santos S et al. Nutrition, 2013.

Dietary Guidelines to Lower CHD-risk Are Mainly Focused on Lowering LDL-cholesterol

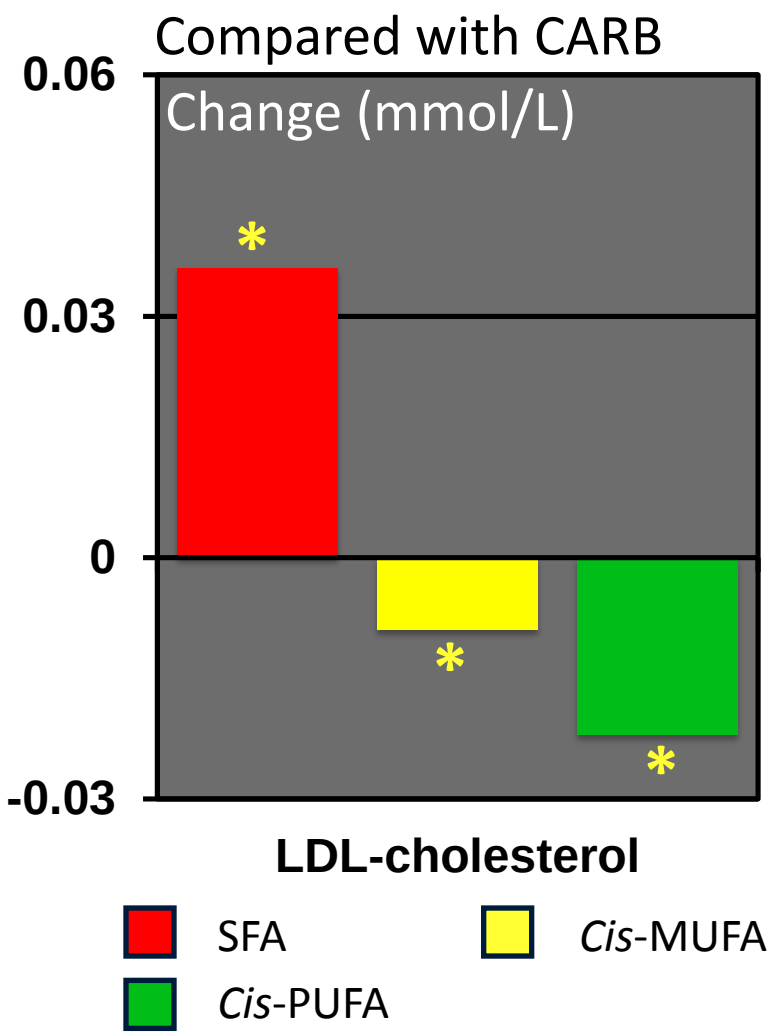




For Dietary Recommendations We Often Rely on Biomarkers

Do SFA increase LDL-cholesterol?	✔
Is LDL-cholesterol a risk factor for CHD?	✔
Include in dietary guidelines	✔

Effects of Different Classes of Fatty Acids on LDL-cholesterol



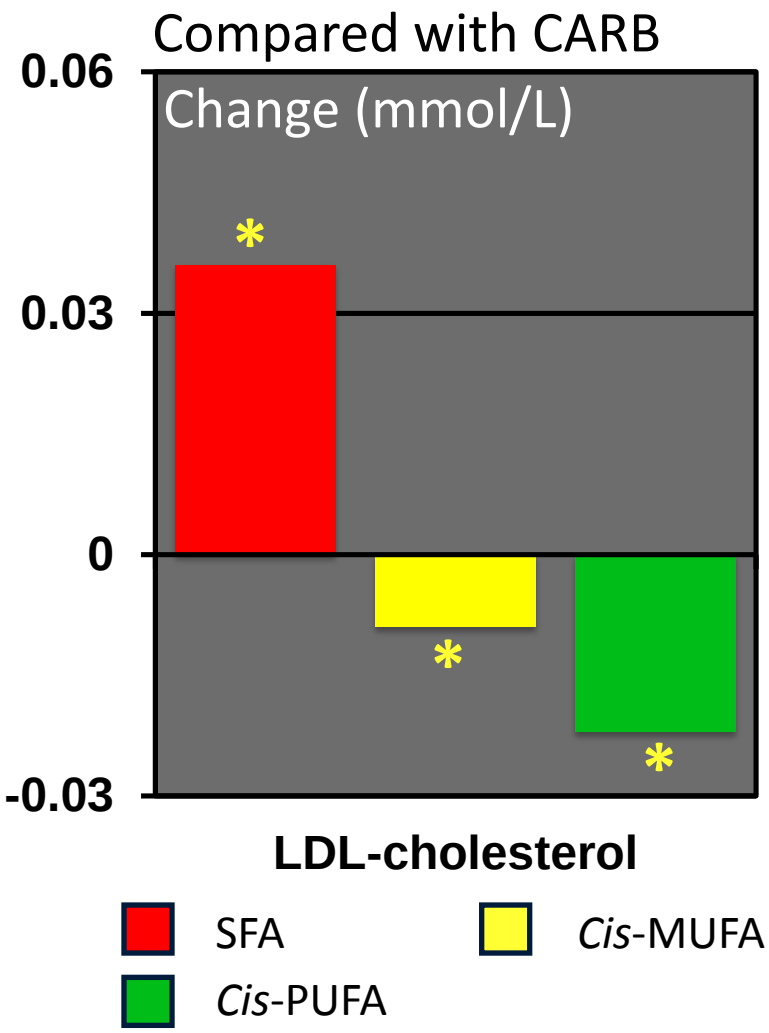
Relative to carbohydrates

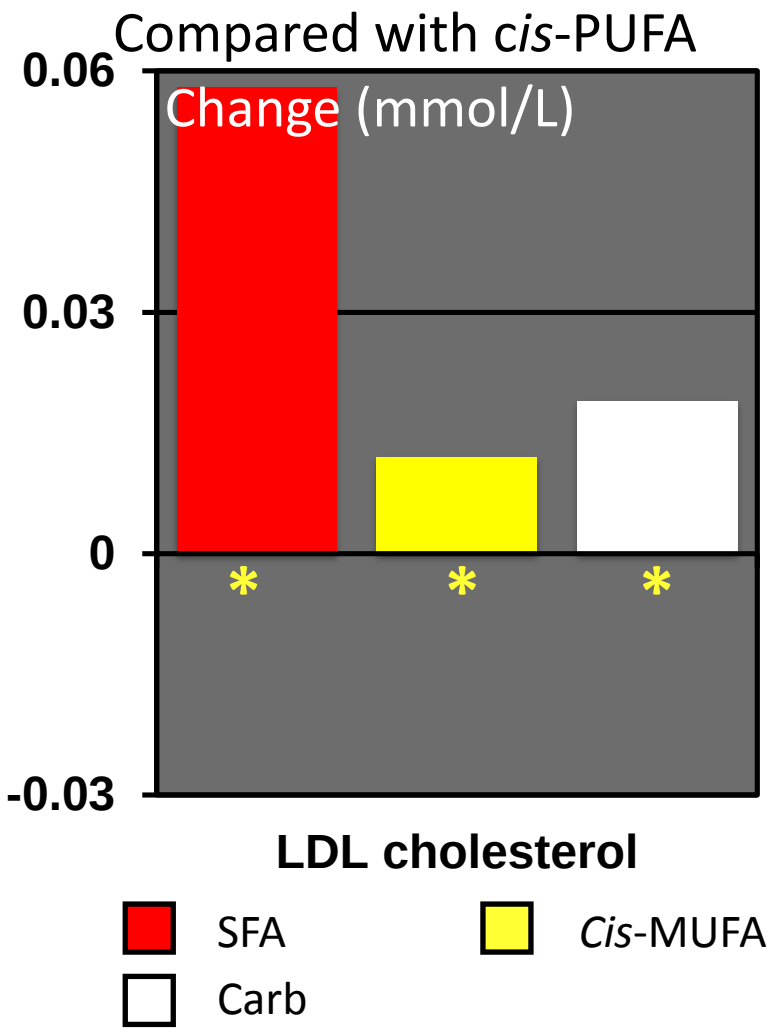
- SFA adversely
- *Cis*-MUFA favorably
- *Cis*-PUFA favorably

change LDL-cholesterol

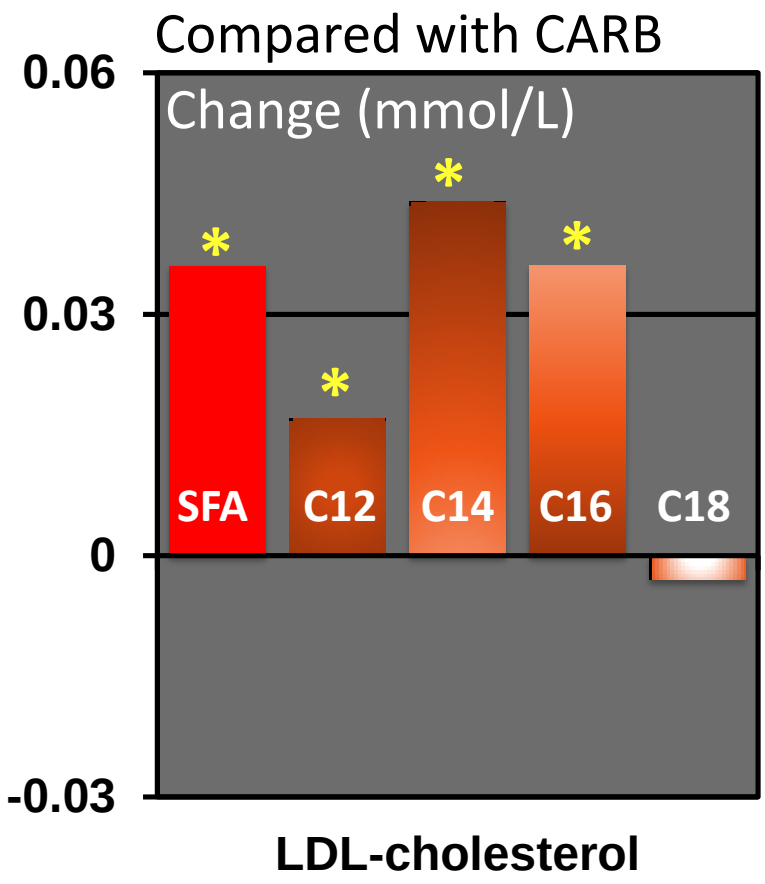
➢ Effects of *cis*-PUFA slightly more favorable

Effects of Different Classes of Fatty Acids and Carbohydrates on LDL-cholesterol





Effects of Individual Saturated Fatty Acids on LDL-cholesterol



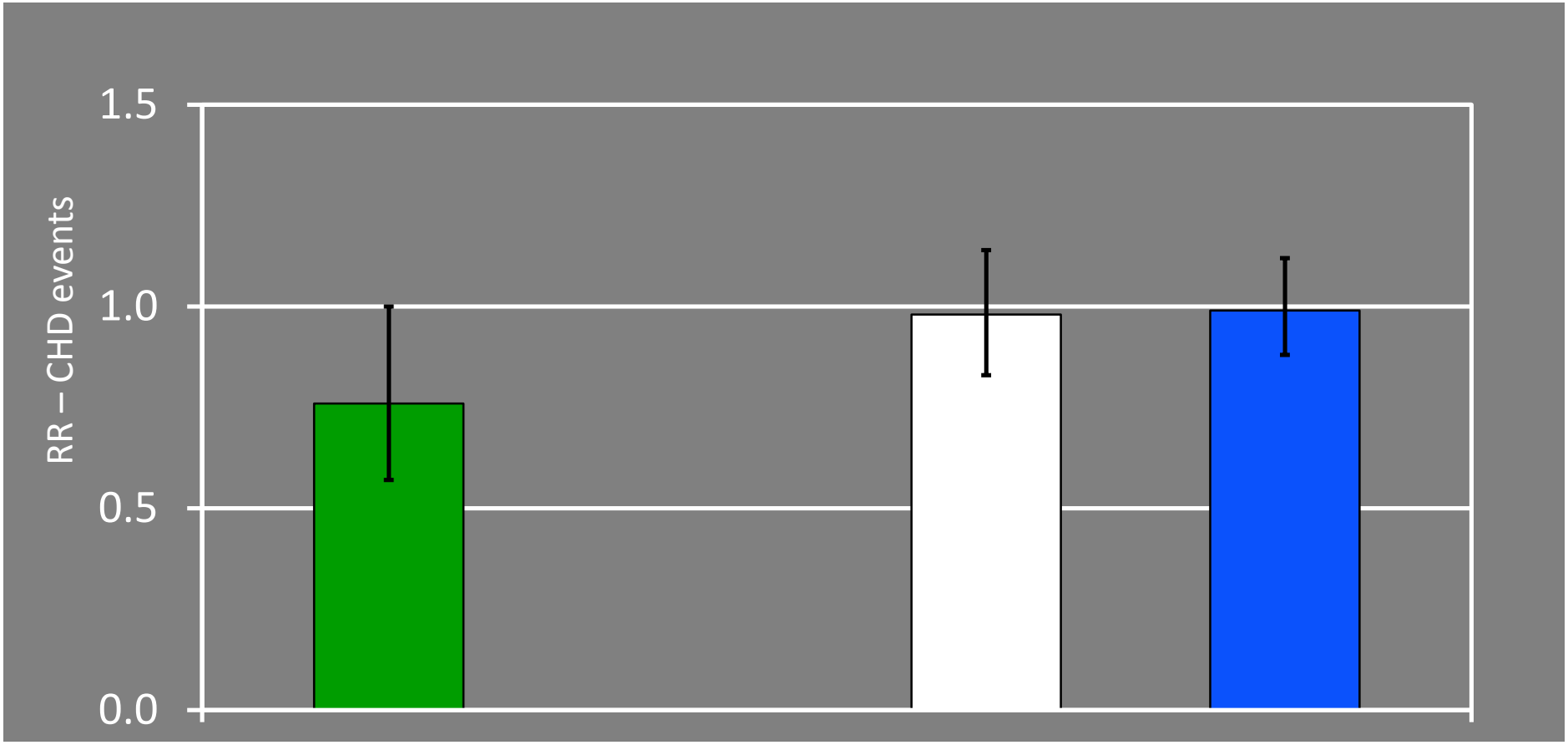
Relative to carbohydrates

- C12:0 (lauric acid)
- C14:0 (myristic acid)
- C16:0 (palmitic acid)

have an adverse effect on LDL-cholesterol

➢ C18:0 (stearic acid) has no effect

Replacement of Saturated Fat Intake and CHD - A Meta-Analysis of 15 RCTs -

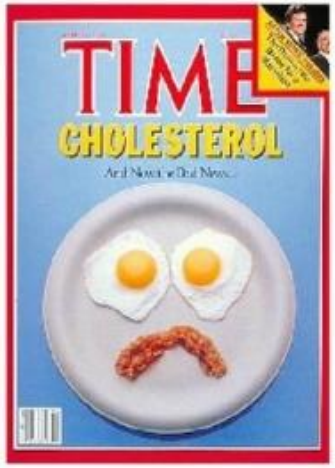


Replacement	PUFA	Carb	Protein
No of participants	>3000	>51,000	>51,000
No of events	737	2846	2833

Hooper L et al. *Cochrane Database of Systematic Reviews* 2015, Issue 6. Art. No.: CD011737

There Is Confusion on the Relation between SFA Intake and CHD

Heart Specialist Calls for Major Repositioning on Saturated Fat, as It's NOT the Cause of Heart Disease



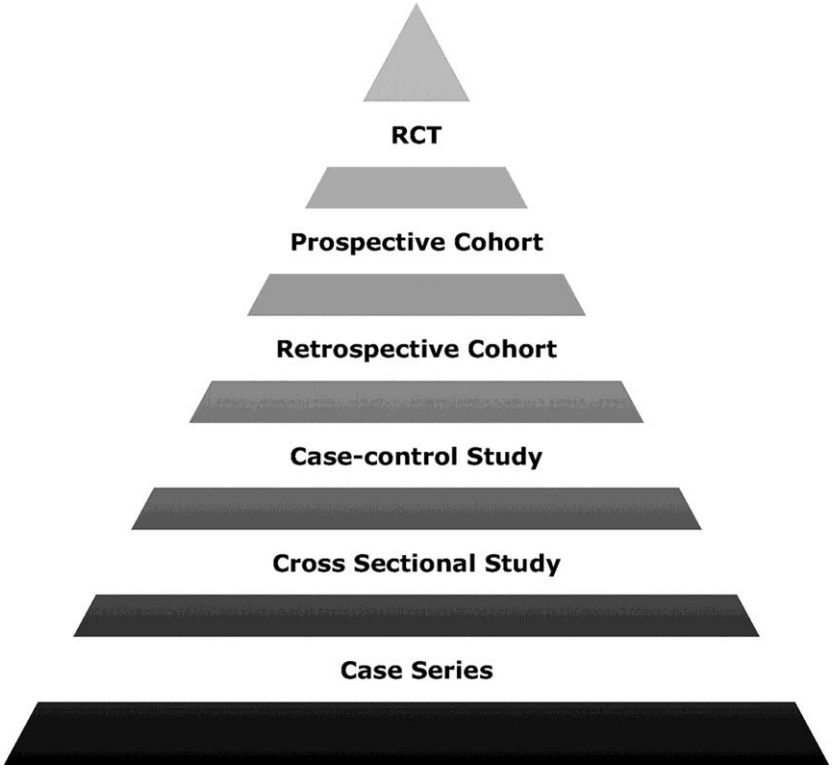
Saturated Fat Does Not Cause Heart Disease

What Causes the Confusion?

- Several - but not all - prospective epidemiological studies and meta-analyses have not shown a relation between saturated fat intake with CHD

Prospective Cohort Studies and RCTs Can Give Complementary - and Contradictory - Information

- Some examples in the field of cardiovascular disease
  - Anti-oxidants
  - Folic acid (Homocysteine)
  - Saturated fatty acids



Estimating Nutrient Intake is Not That Easy

- Important sources of variation
- Errors in identifying foods in food tables
- Discrepancy between food table values and the true composition
- Errors in estimating quantities of food eaten
- Errors in remembering what was eaten
- Variability in food patterns

Jacobs Jr et al. Am J Epidemiol, 1979

Estimating Nutrient Intake is Not That Easy

- Important sources of variation
- Errors in identifying foods in food tables
- Discrepancy between food table values and the true composition
- Errors in estimating quantities of food eaten
- Errors in remembering what was eaten
- Variability in food patterns

For saturated fat, 22 randomly collected 24-h dietary recalls are needed to estimate the true individual mean intake within ±20 % (Balogh et al., Am J Clin Nutr, 1971). Many epidemiological studies have only one recall or a food frequency measure

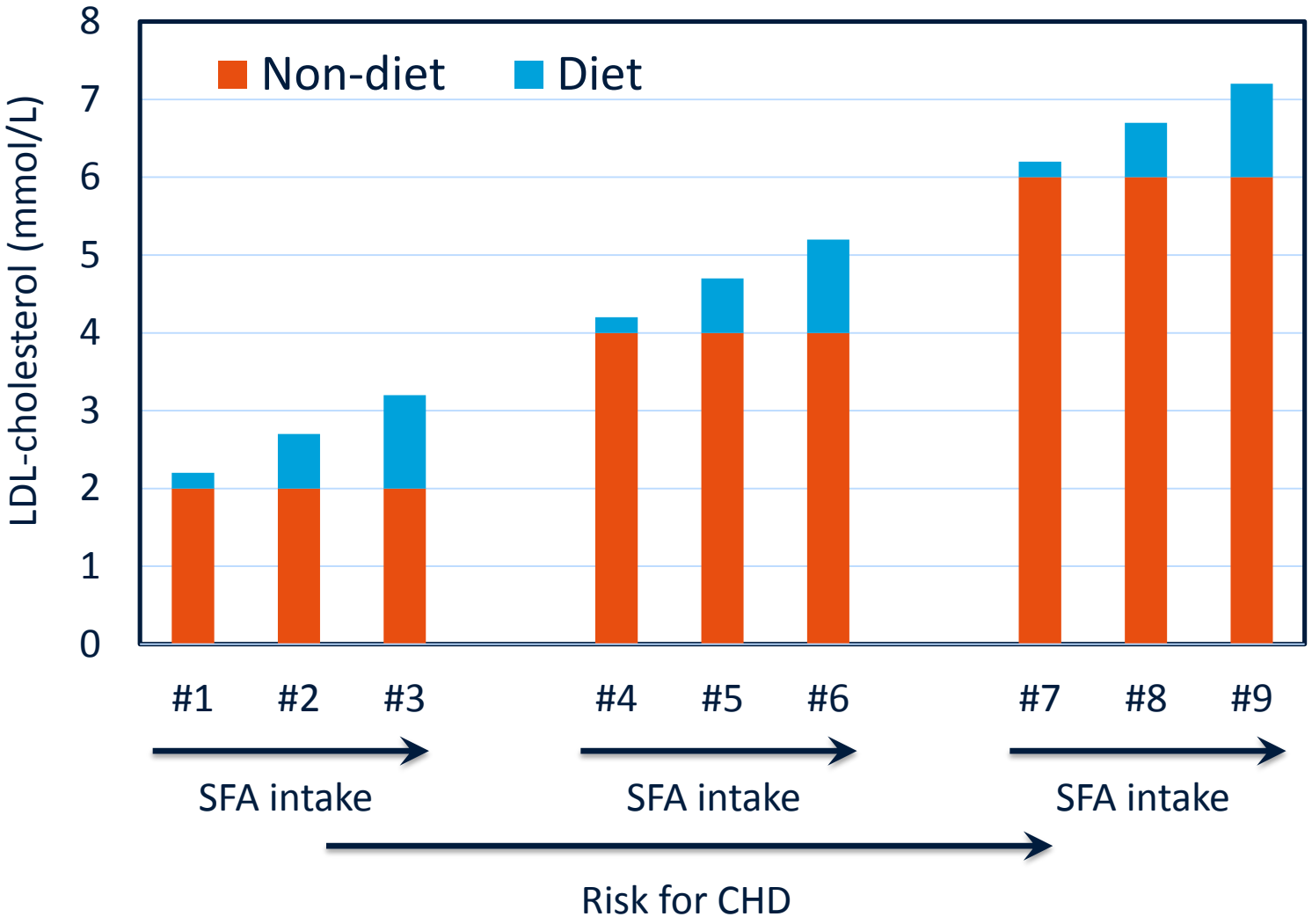
Jacobs Jr et al. Am J Epidemiol, 1979

In Observational Studies, Saturated Fat Intake and Serum LDL-cholesterol Often Do Not Correlate

- Difficult to estimate dietary intake at the individual level
- Variability in serum LDL-cholesterol between and within individuals
- Diet is not the major determinant of individuals' LDL-cholesterol

If saturated fat intake and LDL-cholesterol do not correlate, can we then expect an association between saturated fat intake with CHD?

Can We Expect an Association between Saturated Fat Intake with CHD?

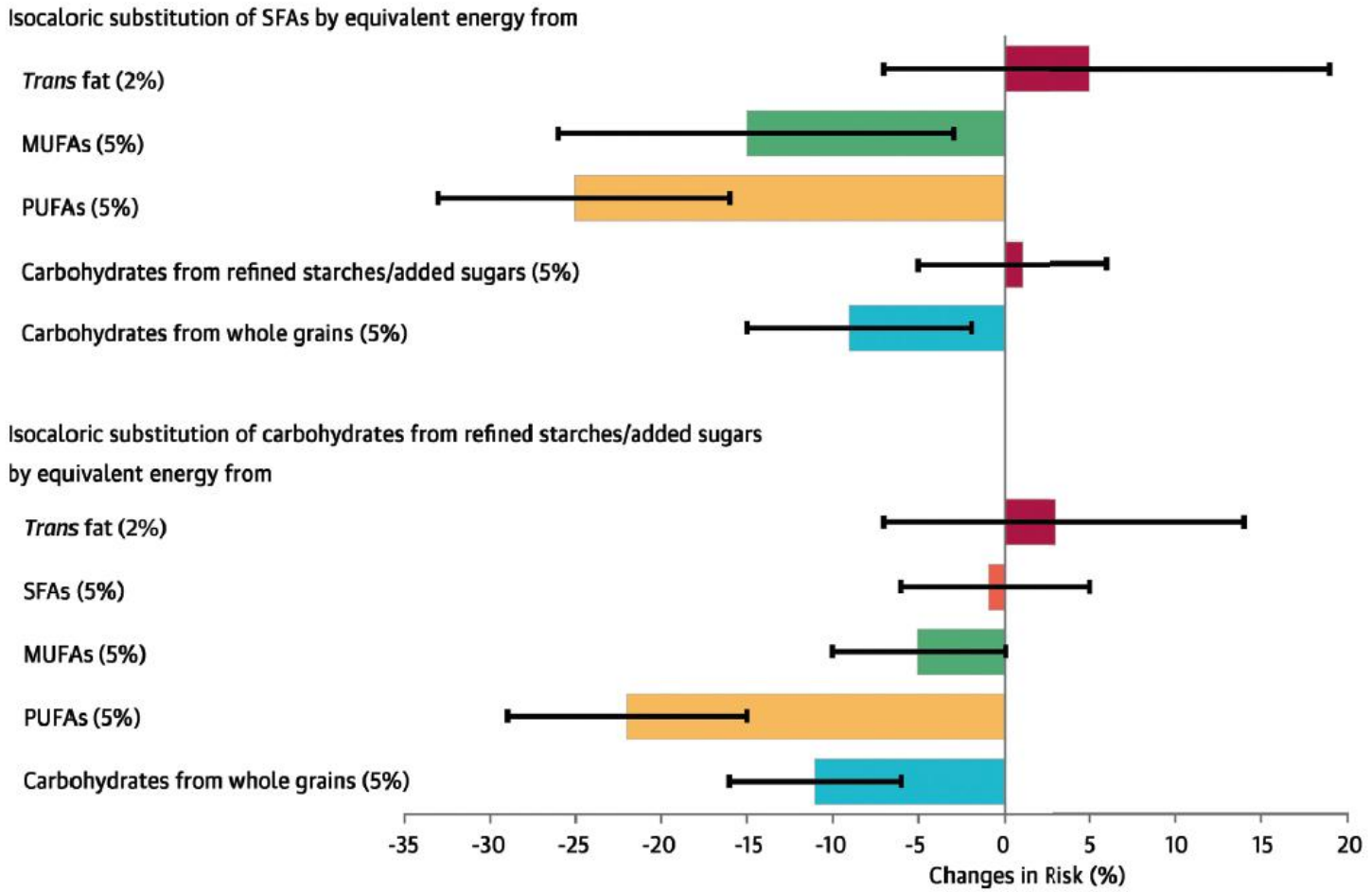


What is the Best (Combination of) Lipid Biomarkers to Predict CHD-risk?

- LDL cholesterol
- Apolipoprotein B
- Small dense LDL
- HDL cholesterol
- Apolipoprotein AI
- Triacylglycerol
- Total to HDL cholesterol
- Postprandial metabolism
- Lp[a]

We Need to Focus on Substitution Scenarios

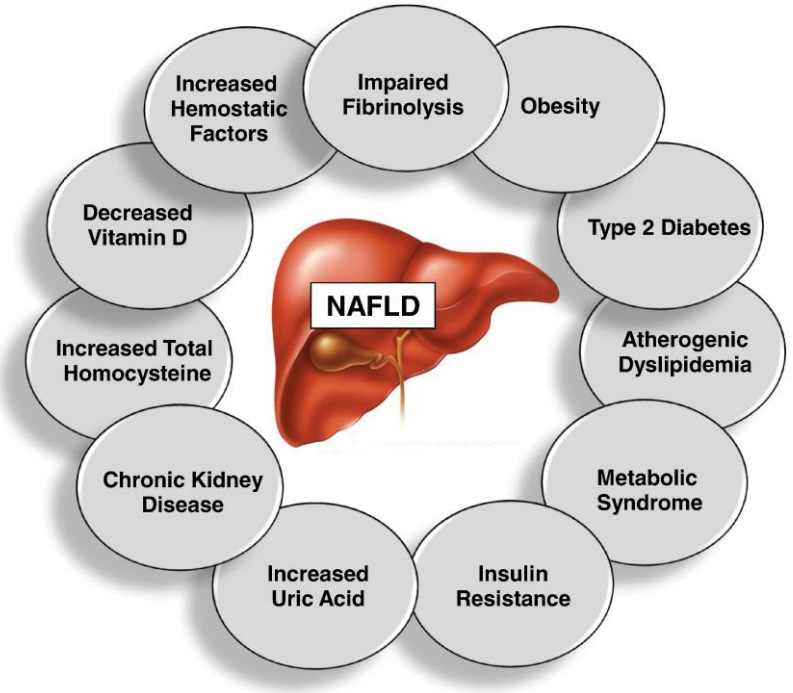
CENTRAL ILLUSTRATION Fat, Carbohydrates, and Heart Disease: Estimated Percentage of Changes in the Risk of Coronary Heart Disease Associated With Isocaloric Substitutions of 1 Dietary Component for Another



Li, Y. et al. J Am Coll Cardiol. 2015; 66(14):1538–48.

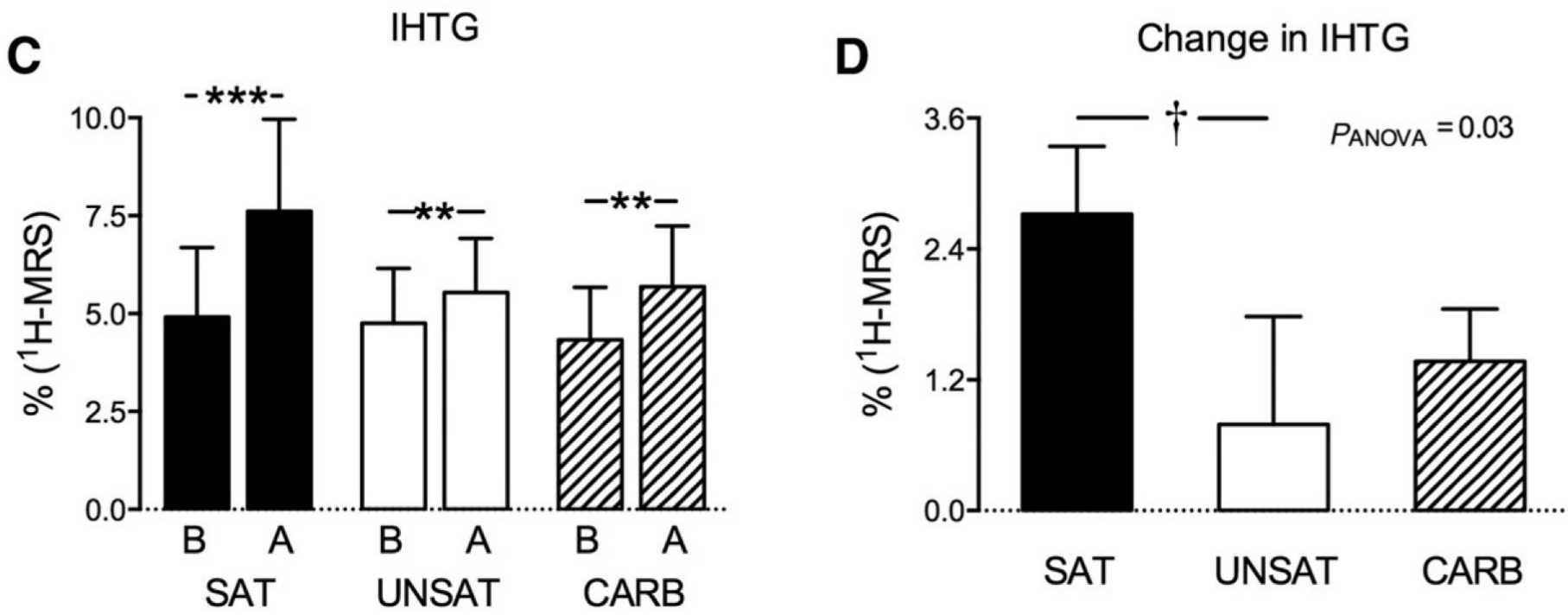
Non-Alcoholic Fatty Liver Disease (NAFLD) Relates to Many Metabolic Risk Factors

Non-Alcoholic Fatty Liver Disease (NAFLD) - characterized by a build up of fat in the liver - relates to many metabolic risk factors



Lonardo et al. Metabolism, 2016

Overfeeding SFA or Simple Sugars Increase Intra Hepatic TriGlyceride (IHTG) Content



Luukkonen et al. Diabetes Care, 2018

Conclusions

- SFA are present in all foods and needed by the body
- There is convincing evidence that diets low in SFA (and high in *cis*-UFA) lowers CHD-risk
- The different SFA have different metabolic effects
- Do not only focus on CHD
- Discuss substitution scenarios
- Nutrients – Foods – Food patterns

Effects of Different Classes of Fatty Acids and Carbohydrates on ApoB100