Do Saturated Fats Cause Chronic Metabolic Diseases?

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Research Funding

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Committees

• Dutch Health Council
• Standing Committee on Healthy Nutrition of the Dutch Health Council
• Scientific advisor ILSI-Europe Task Force “Qualitative 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)
- ......
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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

Dietary Guidelines to Lower CHD-risk Are Mainly Focused on Lowering LDL-cholesterol
For Dietary Recommendations We Often Rely on Biomarkers

Risk Factor Model: Causality

- **Saturated fatty acids** → **LDL-cholesterol** → **CHD**

<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
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</thead>
<tbody>
<tr>
<td>Do SFA increase LDL-cholesterol?</td>
<td>✔️</td>
</tr>
<tr>
<td>Is LDL-cholesterol a risk factor for CHD?</td>
<td>✔️</td>
</tr>
<tr>
<td>Include in dietary guidelines</td>
<td>✔️</td>
</tr>
</tbody>
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Effects of Different Classes of Fatty Acids on LDL-cholesterol

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

Effects of *cis*-PUFA slightly more favorable
Effects of Different Classes of Fatty Acids and Carbohydrates on LDL-cholesterol

Compared with CARB

Compared with cis-PUFA

Change (mmol/L)

LDL-cholesterol

SFA
Cis-MUFA
Cis-PUFA

LDL cholesterol

SFA
Cis-MUFA
Carb
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 -

![Graph showing the replacement of saturated fat intake and CHD events](image)

- **Replacement**
  - PUFA: No of participants >3000, No of events 737
  - Carb: No of participants >51,000, No of events 2846
  - Protein: No of participants >51,000, No of events 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.
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

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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.
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?

**Graph:**

- **Y-axis:** LDL-cholesterol (mmol/L)
- **X-axis:** SFA intake
- **Legend:**
  - Orange: Non-diet
  - Light blue: Diet

**Graph Details:**

- **Risk for CHD:**
  - #1 to #9
  - SFA intake:
    - #1: 2
    - #2: 3
    - #3: 4
    - #4: 5
    - #5: 6
    - #6: 7
    - #7: 8
    - #8: 9
    - #9: 10
What is the Best (Combination of) Lipid Biomarkers to Predict CHD-risk?

- LDL cholesterol
- Apolipoprotein B
- Small dense LDL
- HDL cholesterol
- Apolipoprotein A1
- Triacylglycerol
- Total to HDL cholesterol
- Postprandial metabolism
- Lp[a]
We Need to Focus on Substitution Scenarios
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

Compared with CARB
Change (mg/dL)

Compared with cis-PUFA
Change (mg/dL)

- SFA
- Cis-MUFA
- Cis-PUFA

Compared with Carb
- SFA
- Cis-MUFA

* Indicates statistically significant difference.