Dietary Cholesterol, Guidelines and Your Heart

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University of California Irvine School of Medicine
Director of Nutrition, UC Irvine Preventive Cardiology Program
October 8 2016
Objectives


2. Clear up recent confusion regarding dietary cholesterol.

3. Clear up recent controversy about saturated fat.
UC Irvine Preventive Cardiology Program: 2011
8 visits over 4 months then Monthly Support Group.

UC Irvine Preventive Cardiology Lifestyle-Intervention Program

Cardiologist

Registered Dietitian Nutritionist (RDN)

Exercise Physiologist
### Summary of Recommendations for Lifestyle Management

<table>
<thead>
<tr>
<th>LDL–C - Advise adults who would benefit from LDL–C lowering to:</th>
<th>Evidence</th>
</tr>
</thead>
</table>
| 1. Consume a dietary pattern that emphasizes intake of vegetables, fruits, and whole grains; includes low-fat dairy products, poultry, fish, legumes, non-tropical vegetable oils and nuts; and limits intake of sweets, sugar-sweetened beverages and red meats.  
   a. Adapt this dietary pattern to appropriate calorie requirements, personal and cultural food preferences, and nutrition therapy for other medical conditions (including diabetes mellitus).  
   b. *Achieve this pattern by following plans such as the DASH dietary pattern, the USDA Food Pattern, or the AHA Diet.*  
   c. *Consider referral to a nutrition professional e.g. registered dietitian nutritionist (RDN)* | A (Strong) |
| 2. Aim for a dietary pattern that achieves 5% to 6% of calories from saturated fat. | A (Strong) |
| 3. Reduce percent of calories from saturated fat. | A (Strong) |
| 4. Reduce percent of calories from *trans fat.* | A (Strong) |

*Eckel et al. Circulation. November 12, 2013*
Table 10  Controlled Feeding Trials (Adults)
2013 ACC/AHA Guidelines
ES 11: Saturated Fat

Dietary Pattern (food supplied): 5%–6% saturated fat, 26%–27% total fat, 15%–18% protein, 55%–59% carbohydrate

versus

Control diet: 14%–15% saturated fat, 34%–38% total fat, 13%–15% protein, 48%–51% carbohydrate

Results: LDL-C lowered 11–13 mg/dL in 2 studies and 11% in another study.

Strength of Evidence: High

Change in LDL-C with Different Dietary Fats Substituted for Carbohydrates

Micha et al. *Lipids*, 2010

- Change in LDL-C (mmol/L)

- Percentage of Calories Replaced

- TFA replacing CHO
- SFA replacing CHO
- MUFA replacing CHO
- PUFA replacing CHO
ES16. Dietary Cholesterol

There is insufficient evidence to determine whether lowering dietary cholesterol intake reduces LDL-C. (RCTs 1998-2009)

Strength of Evidence: Insufficient
Dietary Cholesterol Controversy

“Cholesterol is not a concern for overconsumption” according to the DGAC 2015 Advisory Committee

Put those Eggs back on your shopping list without the fear of cholesterol!
Current Intake of Dietary Cholesterol in the US, NHANES 2011-2012

<table>
<thead>
<tr>
<th>Gender</th>
<th>Cholesterol Intake</th>
</tr>
</thead>
<tbody>
<tr>
<td>Males 20+</td>
<td>338 mg/day</td>
</tr>
<tr>
<td>Females 20+</td>
<td>229 mg/day</td>
</tr>
<tr>
<td>Combined</td>
<td>282 mg/day</td>
</tr>
</tbody>
</table>

DATA SOURCE: What We Eat in America, NHANES 2011-2012.
Forty studies (17 cohorts in 19 publications with 361,923 subjects and 19 trials in 21 publications with 632 subjects) published between 1979 and 2013 were included.

Dietary cholesterol was not significantly associated with coronary artery disease, ischemic stroke or hemorrhagic stroke.

Dietary cholesterol significantly increased both serum total cholesterol and LDL-C.

Dietary cholesterol significantly increased HDL-C and the LDL-C:HDL-C ratio.
Dear Secretaries Burwell and Vilsack

On behalf of the ACC, we ask that the forthcoming Dietary Guidelines for Americans include clear guidance regarding the importance of limiting dietary cholesterol, as has been done in every Dietary Guidelines Report since 1980. In light of new research findings, as well as a robust body of prior research, we ask that the cholesterol intake guidance in the previous Guidelines not be lowered.
October 7 2015 Letter to DHHS and USDA
By Kim Williams, MD  President ACC

• “Specifically, we would like to see the following language retained: Consuming less than 300 mg per day of cholesterol can help maintain normal blood cholesterol levels. Consuming less than 200 mg per day can further help individuals at high risk of cardiovascular disease. “

• “The 2013 ACC/AHA report covered selected RCTs published 1998 to 2009. Four meta-analyses were available but not included. All four, plus a fifth meta-analysis (Berger 2015), showed significant positive relationships between dietary cholesterol and blood cholesterol.”
Dietary Guidelines for Americans

DIETARY GUIDELINES FOR AMERICANS
2015-2020
EIGHTH EDITION
2015-2020 Dietary Guidelines for Americans
Key Recommendations

• A healthy eating pattern limits saturated fats, trans fats, added sugars and sodium

• Key diet recommendations of particular public health concern that should be limited:
  – Consume less than 10% of calories per day from added sugars
  – Consume less than 10% of calories per day from saturated fats
  – Consume less than 2,300 mg/d of sodium
  – If alcohol is consumed, use moderation, up to 1 drink per day for women and up to 2 drinks per day for men—and only by adults of legal drinking age

De Salvo KB et al. Dietary Guidelines for Americans. JAMA 2016 315: 457-8
However, the 2015 US Dietary Guidelines Removed the 300 mg/day limit on Dietary Cholesterol but stated

“The Key Recommendation from the 2010 Dietary Guidelines to limit consumption of dietary cholesterol to 300 mg/day was not included in the 2015 edition, but this change does not suggest that dietary cholesterol is no longer important to consider when building healthy eating patterns.”

http://health.gov/dietaryguidelines/2015/guidelines
As recommended by the IOM, individuals should eat as little dietary cholesterol as possible while consuming a healthy eating pattern. In general, foods high in dietary cholesterol are also high in saturated fats e.g. fatty meats and high-fat dairy products.

http://health.gov/dietaryguidelines/2015/guidelines
Hijacking of the 2015 Dietary Guidelines
Science on Cholesterol


“Go ahead and have some eggs,” wrote the *Washington Post*. The Guidelines are “stepping back” from previous advice about cholesterol, the newspaper explained.
Some media got it right!

Heard that you don’t have to be concerned about cholesterol anymore? **Wrong**

**Correct:** “Eat as little dietary cholesterol as possible in a healthy diet” the new Dietary Guidelines advise.

*David Schardt* • January 18, 2016

Posted in [Healthy Tips](#), [Heart and Disease](#).
National Lipid Association Recommendations for Patient Centered Management of Dyslipidemia - Part 2 Report

NLA Expert Panel

Terry Jacobson, MD, Kevin Maki, PhD, Carl Orringer, MD, Peter Jones, MD, Penny Kris-Etherton, PhD, RDN; Geeta Sikand, MS, RDN, Ralph La Forge, MSc, Stephen Daniels, MD, PhD, Don Wilson, MD, Pamela Morris, MD, Robert Wild, MD, PhD, MPH, Scott Grundy, MD, PhD, Martha Daviglus, MD, PhD, Keith Ferdinand, MD, Krishnaswami Vijayaraghavan, MD, Prakash Deedwania, MD, Judith Aberg, MD, Katherine Liao, MD, MPH, James McKenney, PharmD, Joyce Ross, MSN, CRNP, Lynne Braun, PhD, CNP, Matthew Ito, PharmD, Harold Bays, MD, W. Virgil Brown, MD.

2015 NLA Part 2 Recommendations to lower Atherogenic Cholesterol

4 Content Areas

1. **Lifestyle Therapies**
   - Nutrition
   - Exercise/Physical Activity

2. **Groups with Special Considerations**: Children to Seniors, Hispanic, Latinas, African Americans, South Asians, American Indians

3. **High risk conditions**: HIV, rheumatoid arthritis, residual risk conditions

4. **Improving Patient Outcomes**
   - Patient Adherence
   - Team-based Collaborative Care
NLA PART 2 2015 Expert Panel
Nutrition Expert Panel

Penny Kris-Etherton, PhD RDN CLS FNLA: Co-Chair
Geeta Sikand, MS RDN CLS FNLA FAND: Co-Chair
Kevin Maki, PhD CLS: Co-Chair
Julie Bolick, MS RDN CLS FNLA
Mary Dicklin, PhD
Carol Kirkpatrick, PhD RDN CLS FNLA
Kathy Rhodes, PhD RDN
Nancy Smith, MS RDN CLS

- Effect of cardio-protective eating patterns on ASCVD risk: DASH, Mediterranean, Vegetarian/Vegan.
- Effect of weight loss, saturated fat, omega-6, omega-3 and monounsaturated fats, dietary cholesterol, fiber, plant sterols & plant stanols, legumes, soy, nuts and alcohol.
- Dietary treatment of moderate vs severe hypertriglyceridemia.
- Effectiveness of medical nutrition therapy (MNT) by registered dietitian nutritionists (RDN).

Evidence Graded for Strength of Recommendation

A = Strong
B = Modest
C = Weak
D = Recommend Against
E = Expert opinion

Consideration given to net benefits, risks or harms

Journal of Clinical Lipidology (2015) 9, S1–S122
Evidence Graded for Quality

**High**
- Well designed, well executed RCTs
- Well conducted meta-analyses
- High certainty about the estimate of effects

**Moderate**
- RCTS with minor limitations
- Well designed well executed non-randomized trials
- Moderate certainty about the estimate of effects

**Low**
- Non randomized controlled trials & observational studies
- with major limitations
- Low certainty about the estimate of effects
1. Medical nutrition therapy (MNT)/nutrition education by a registered dietitian nutritionist (RDN) with follow-up and monitoring are recommended to personalize dietary pattern and to promote long-term dietary adherence.

2. Data strongly indicate MNT by a RDN improved lipid profiles and cardio-metabolic risk factors and favorably effected patients’ quality of life.

**Strength of Evidence: A**

Journal of Clinical Lipidology (2015) 9, S1–S122
Role of RDN in the Management of Dyslipidemia

Systematic Review (8 studies): 1991-2008

• 3-6 MNT visits with RDN over 8-12 weeks
  • Reduced LDL-C: 7-15%

• 2 studies: magnitude of LDL-C reduction increased with time spent with RDN.

Effects of Dietary Patterns on CVD risk factors in Randomized Controlled trials.

NLA Recommendations for Lowering Atherogenic Cholesterol (LDL-C and Non-HDL-C)

2. The NLA Expert Panel recommends a cardio-protective eating pattern e.g. DASH, Mediterranean or Vegetarian, with <7% of energy from saturated fat, minimal intake of trans fat to lower LDL-C & non-HDL-C and for improving overall cardiovascular health.

Strength of evidence: A

Journal of Clinical Lipidology (2015) 9, S1–S122
Which Dietary Patterns are Effective for CVD Risk Reduction & lowering LDL-C?

NIH-AARP Diet and Health Study (n = 492,823).

1. DASH (Dietary Approaches to Stop Hypertension)
2. Healthy Eating Index (HEI) (USDA diet)
3. Alternative Healthy Eating Index (AHEI) (AHA diet)
4. Mediterranean style dietary pattern

Conclusion

All whole foods dietary patterns are effective.

Evidence among men (n=242,321) and women (n=182,342)

Multivariate HRs and 95% CIs for all cause mortality and CVD, comparing highest (Q5) to lowest quintile index scores (Q1) for the HEI-2010, AHEI-2010, aMED, and DASH Score

## Components of the DASH Diet
(based on 2000 kcal daily)

<table>
<thead>
<tr>
<th>Food Group</th>
<th>Daily Servings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grains (whole grains recommended)</td>
<td>6-8 [½ cup servings]</td>
</tr>
<tr>
<td>Vegetables</td>
<td>4-5</td>
</tr>
<tr>
<td>Fruits</td>
<td>4-5</td>
</tr>
<tr>
<td>Fat-Free or Low-Fat Dairy</td>
<td>2-3</td>
</tr>
<tr>
<td>Lean Meat, Poultry, and Fish</td>
<td>6 or less [1oz lean meat/fish]</td>
</tr>
<tr>
<td>Nuts, Seeds, and Legumes</td>
<td>4-5 weekly</td>
</tr>
<tr>
<td>Fats and Oils</td>
<td>2-3</td>
</tr>
<tr>
<td>Sweets and Added Sugars</td>
<td>5 or less weekly</td>
</tr>
</tbody>
</table>

PREDIMED Trial: The Incidence of Acute Myocardial Infarction, Stroke, and Death from Cardiovascular Causes by Treatment


Primary End Point (acute myocardial infarction, stroke, or death from cardiovascular causes)

- Med diet, EVOO: hazard ratio, 0.70 (95% CI, 0.53–0.91); P=0.009
- Med diet, nuts: hazard ratio, 0.70 (95% CI, 0.53–0.94); P=0.02

<table>
<thead>
<tr>
<th>Years</th>
<th>Control diet</th>
<th>Med diet, EVOO</th>
<th>Med diet, nuts</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>2450</td>
<td>2543</td>
<td>2454</td>
</tr>
<tr>
<td>1</td>
<td>2268</td>
<td>2486</td>
<td>2343</td>
</tr>
<tr>
<td>2</td>
<td>2020</td>
<td>2320</td>
<td>2093</td>
</tr>
<tr>
<td>3</td>
<td>1583</td>
<td>1987</td>
<td>1657</td>
</tr>
<tr>
<td>4</td>
<td>1268</td>
<td>1687</td>
<td>1389</td>
</tr>
<tr>
<td>5</td>
<td>946</td>
<td>1310</td>
<td>1031</td>
</tr>
</tbody>
</table>
Kwok et al. (2014): Meta-analysis of eight observational studies that evaluated clinical outcomes associated with a vegetarian compared to a non-vegetarian diet, reported that, for ischemic heart disease, lower risk was associated with a vegetarian diet.

Keys et al. (1999): Compared with regular meat eaters, mortality from ischemic heart disease was 20% lower in occasional meat eaters, 34% lower if they ate fish but no meat, 34% lower in lacto-ovo-vegetarians and 26% lower in vegans.
NLA Recommendations for Lowering Atherogenic Cholesterol (LDL-C and Non-HDL-C)

3. The cardio protective eating pattern should limit cholesterol intake to <200 mg/day to lower levels of atherogenic cholesterol (LDL-C and non-HDL-C)

Strength of evidence B

Journal of Clinical Lipidology (2015) 9, S1–S122
Dietary Cholesterol Overview

Most of the >400 studies to date show dietary cholesterol has a modest effect to raise LDL-C (about 2 mg/dL per 100 mg/d of dietary cholesterol consumed) and non-HDL-C.

Genetic studies: even modest increase or decrease in LDL-C and non-HDL-C have an impact on ASCVD risk if maintained over a long period based on intervention studies, i.e., lower is better and even just a bit lower is better if maintained over an extended period.

Journal of Clinical Lipidology (2015) 9, S1–S122
Controlled Cholesterol Feeding Studies Show Modest Effects

• Dietary cholesterol modestly increases LDL-C. For every 100 mg/day consumed, LDL-C increases ≈2 mg/dL.
• Marked individual variability in the response to dietary cholesterol intake.
• Small reductions in LDL-C decrease CVD events.
• The increase in HDL-C with dietary cholesterol is of uncertain clinical importance.
• The increase in LDL-C is related to the baseline cholesterol intake. The lower the intake, the greater the response.
Dietary Cholesterol Dose Response Study
Controlled Feeding Trial

- Evaluated 4 dietary conditions each for 8 weeks with washouts between treatments in 20 men.
- Lipids measured by ultra-centrifugation
- LDL-C and Apo B modestly rose 1.38 mg/dL and 1.19 respectively per 100 mg dietary cholesterol consumed.
- Responses varied widely.

Individual Variability in Dose-Response Relationship for Total-C and LDL-C with Increasing Dietary Cholesterol

- Results show a wide range of mostly positive responses to dietary cholesterol. However, three subjects actually had negative cholesterol responses to increasing eggs, while several responded by more than twice the mean.

4. For known or suspected hyper-responders due to genetic or other reasons, consider further reduction in dietary cholesterol beyond the <200 mg/day that is recommended as part of the cardio-protective eating pattern.

Consumption of very low intakes of dietary cholesterol (near 0 mg/day) may be helpful for such individuals (e.g. defect in ABC G5 and G8 that transport sterols including cholesterol)

**Strength of Evidence B**

Journal of Clinical Lipidology (2015) 9, S1–S122
Eggs and Cholesterol
Observational Evidence

Observational evidence suggests that eggs and dietary cholesterol consumption are not consistently associated with increased ASCVD risk except in persons with diabetes.

Observational studies are subject to various types of bias and confounding.

Journal of Clinical Lipidology (2015) 9, S1–S122
2015 NLA Expert Panel Conclusions
Dietary Cholesterol Intake and ASCVD

• Scientific evidence supports NLA recommendation for <200 mg/day of dietary cholesterol.

• Variability in response to dietary cholesterol makes it difficult to identify hyper-responders.

• Even small reductions in LDL-C have CVD benefits.

• The growing prevalence of diabetes is a further justification for restriction of dietary cholesterol.

Journal of Clinical Lipidology (2015) 9, S1–S122
2015 NLA Nutrition Recommendations to lower levels of Atherogenic Cholesterol

5. Any healthy eating pattern that emphasizes variety of plant foods, lean protein, < 7% SFA, minimal trans fat e.g. DASH, USDA (healthy U.S.-style), AHA, Mediterranean-style, and vegetarian/vegan.

However the dietary pattern should be personalized by a RDN based on patients’ specific dyslipidemia integrating patients’ personal and cultural food preferences.

Strength of evidence A
6. Replace with unsaturated fats (mono- and polyunsaturated fats), as well as lean proteins, to reach a goal of <7% of energy from saturated fats.

- **Strength of evidence:** A

Journal of Clinical Lipidology (2015) 9, S1–S122
The 2015-2020 US Dietary Guidelines
Saturated Fat

Strong and consistent evidence shows that replacing saturated fats with unsaturated fats, especially polyunsaturated fats, is associated with reduced blood levels of T-C and LDL-C.

Additionally, strong and consistent evidence shows that replacing saturated fats with polyunsaturated fats is associated with a reduced risk of CVD events (heart attacks) and CVD-related deaths.

http://health.gov/dietaryguidelines/2015/guidelines
Saturated Fat controversy?

TIME
Eat Butter.
Scientists labeled fat the enemy. Why they were wrong

Islets of Humor™
By Theresa Garnero

I’m a good fat!

Show off...

BUtTER
The authors concluded that the evidence does not clearly support cardiovascular guidelines that encourage high consumption of polyunsaturated fatty acids and low consumption of saturated fatty acids.
problems with chowdhury meta-analysis. 2014
see comments on Ann Intern Med website:

• Gross errors in data abstraction from original papers
• Omitted important studies, especially on PUFA
• Omitted important evidence (e.g., feeding studies)
• Lack of specific comparisons, and failure to acknowledge this
• Misrepresented findings (especially for long-chain N-3 PUFA)
• Failed to acknowledge other summaries based on primary data that had different conclusions

Correction: Association of Dietary, Circulating, and Supplement Fatty Acids With Coronary Risk

See Also:
Association of Dietary, Circulating, and Supplement Fatty Acids With Coronary Risk: A Systematic Review and Meta-analysis


A recent meta-analysis (1) contained the following numerical errors. First, the summary estimate for total saturated fatty acids in prospective cohort studies of dietary fatty acid intake should be 1.03 (95% CI, 0.98 to 1.07) based on 20 studies, 276 763 participants, and 10 155 events. Second, the summary estimate for total monounsaturated fatty acids in prospective cohort studies of dietary fatty acid intake should be 1.00 (CI, 0.91 to 1.10) based on 9 studies, 144 219 participants, and 6031 events. Third, the number of participants included in the analysis of α-linoleic in prospective cohort studies of dietary fatty acid intake should be 157 258 and 7431 events. Fourth, the summary estimate for total long-chain ω-3 fatty acids in prospective cohort studies of dietary fatty acid intake should be 0.87 (CI, 0.78 to 0.97) based on 16 studies, 422 786 participants, and 9089 events. Fifth, the summary estimate for total ω-6 fatty acids in prospective cohort studies of dietary fatty acid intake should be 0.98 (CI, 0.90 to 1.06) based on 8 studies, 206 376 participants, and 8155 events. Sixth, the summary estimate for the effect of ω-6 fatty acids in randomized, controlled trials should be 0.86 (CI, 0.69 to 1.07) based on 8 studies, 459 events per 7245 participants in the intervention group, and 515 events per 7231 participants in the control group. These corrections, however, do not affect the main conclusions reported in the original article.
Response to Chowdhury et al. 2014

“To give people the message that they don’t have to worry about saturated fat and can go back to butter, cheese, and lots of red meat would be really wrong.”

Alice Lichtenstein, PhD, RD
Past Chair, Amer Heart Assoc Nutrition Committee
Professor of Nutrition, Tufts University
Reducing Saturated Fat is associated with Lower CHD Risk

- Prospective Cohort Study of 84,268 women (Nurses Health Study) and 42,908 men (Health Professionals Follow up Study) for 20-24 years.
- Replacing 5% of calories from saturated fat
  - With PUFAs lowers risk 25%
  - With MUFAs lowers risk 15%
  - With whole grain carbs lowers risk 9%

Li et al. JACC 2015; 66(14) 1538-47
The Case for Eating Butter Just Got Stronger

A new study found no link between eating butter and heart disease

Data from 4 prospective cohorts with 175,612 participants and 9,783 cases for CVD, 3 cohorts of 173,853 participants and 5,299 events for stroke, and 3 studies of 149,056 participants and 4,484 cases of CHD
“In a meta-analysis such as this, there is no specific comparison (i.e. butter vs. olive oil), so the default comparison becomes butter vs. the rest of the diet. That means butter is being compared to a largely unhealthy mix of refined grains, soda, other sources of sugar, potatoes, and red meat (for reference, less than five percent of the US population meet the Dietary Guidelines for Americans). Partially hydrogenated oils—a source of trans fat—were also in the mix, as they would have been high in the food supply during much of the time period of the studies included.”
WHO 2016 Report: Conclusion
Saturated Fat Intake

• Results of the multiple regression analysis indicated that effects on the serum lipoprotein profile of reducing SFA intake by replacing a mixture of SFA with cis-PUFA (predominantly linoleic acid and α-linolenic acid) or cis-MUFA (predominantly oleic acid) were more favorable than replacing SFA with a mixture of carbohydrates. For total and LDL cholesterol and triglycerides in particular, the most favorable effects were observed for cis-PUFA. These results are consistent across a wide range of SFA intakes including intakes of less than 10% of total energy intake.

http://www.who.int/nutrition/publications/nutrientrequirements/sfa_systematic_review/en
“After reviewing the evidence the NLA Expert Panel consensus is that coconut oil must be avoided or used sparingly by patients who would benefit from reductions in atherogenic cholesterol.”

1 TBS virgin coconut oil = 13.6 gm SF
1 TBS coconut oil = 11.7 gm SF
2000 kcal = 15.5 gm/day = 7% of energy from SFA

2015 NLA Nutrition Recommendations

Weight Reduction

7. Weight loss of 5-10% body weight is generally recommended for overweight or obese individuals to lower atherogenic lipoproteins and improve other ASCVD risk factors.

Several healthy patterns e.g. Mediterranean-style, DASH, USDA, and vegetarian diets can also assist with weight reduction and tailored to patients’ personal and cultural needs.

Strength of Evidence  A

8. **Plant sterols and stanols** (~2 g/day) are recommended for cholesterol lowering, as well as **viscous fibers** (5 to 10 g/day or greater).

**Strength of Evidence B**

However, individuals with phytosteroolemia (sitosteroolemia) should avoid foods fortified with stanols and sterols (defect in at least one transporter e.g., ABC G5 and G8)

Predicting Reductions in LDL-C and non-HDL-C (WIIFM)

• Dietary pattern low in saturated, trans fat & dietary cholesterol -5 to -10%
• Loss of 5% of body weight -3 to 5%
• 2 g/day plant sterols/stanols
  or
• 7.5 g/day viscous fiber -4 to -10%

Total reduction -12 to -25%

NLA Nutrition Recommendations for lowering Atherogenic Cholesterol: Summary

- Refer to a Registered Dietitian Nutritionist (RDN) to personalize cardio-protective dietary patterns to patients’ specific dyslipidemia, personal and cultural food preferences and to achieve a healthy weight.

- Emphasize plant foods and lean protein foods e.g. fruits, vegetables, whole grains, fish, omega 6, omega 3, monounsaturated fats, nuts, seeds, legumes and low-fat dairy.

- Limit saturated fat to < 7% of energy intake & dietary cholesterol <200 mg/d.

- Include viscous fiber and plant stanols/sterols.

- Reduce sodium and sugar.

Thank you
### Comparison of Saturated Fat Recommendations

#### For Lowering Atherogenic Lipids

<table>
<thead>
<tr>
<th>Organization/Year</th>
<th>Percentage of Calories</th>
</tr>
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<tbody>
<tr>
<td>National Lipid Association 2015</td>
<td>&lt; 7%</td>
</tr>
<tr>
<td>International Atherosclerosis Society 2013</td>
<td>&lt; 7%</td>
</tr>
<tr>
<td>ACC/AHA 2013 Guidelines</td>
<td>5-6%</td>
</tr>
<tr>
<td>American Diabetes Association 2014</td>
<td>&lt; 10%</td>
</tr>
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</table>

#### For Americans in General

<table>
<thead>
<tr>
<th>Organization/Year</th>
<th>Percentage of Calories</th>
</tr>
</thead>
<tbody>
<tr>
<td>Academy of Nutrition and Dietetics 2014</td>
<td>&lt; 10%</td>
</tr>
<tr>
<td>2015 Dietary Guidelines for Americans</td>
<td>&lt; 10%</td>
</tr>
</tbody>
</table>
Purpose: To assess the literature on the effect of coconut consumption on cardiovascular risk factors and outcomes.

Methods: 21 studies were included in the analyses (8 clinical trials and 13 observational studies).

Conclusion: Coconut oil generally raised total and LDL-C to a greater extent than unsaturated plant oils, but to a lesser extent than butter.

Overall, the weight of the evidence from intervention studies to date suggests that replacing coconut oil with unsaturated fats would alter blood lipids consistent with a reduction in CVD risk factors.

This review does not support popular claims purporting that coconut oil is a healthy oil to reduce CVD risk.

<table>
<thead>
<tr>
<th>Country</th>
<th>Organization</th>
<th>Cholesterol Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td>Heart Foundation</td>
<td>No cholesterol recommendations or upper limit.</td>
</tr>
<tr>
<td>International</td>
<td>WHO</td>
<td>$&lt;300 \text{ mg/dy}}$ dietary cholesterol/day</td>
</tr>
<tr>
<td>International</td>
<td>International Atherosclerosis Society</td>
<td>$&lt;200 \text{ mg/dy}}$ dietary cholesterol/day</td>
</tr>
<tr>
<td>United States</td>
<td>National Lipid Association 2015</td>
<td>$&lt;200 \text{ mg/dy}}$ dietary cholesterol/day</td>
</tr>
<tr>
<td>United States</td>
<td>American Diabetes Association (2013)</td>
<td>$&lt;300 \text{ mg/dy}}$ dietary cholesterol/day</td>
</tr>
<tr>
<td>United States</td>
<td>ACC/AHA (2013)</td>
<td>“There is insufficient evidence to determine whether lowering dietary cholesterol reduces LDL-C”</td>
</tr>
<tr>
<td>United States</td>
<td>2010 Dietary Guidelines for Americans</td>
<td>Consuming $&lt; 300 \text{ mg/day}$ can help maintain normal blood cholesterol levels. Consuming $&lt; 200 \text{ mg/day}$ can further help individuals at high risk of cardiovascular disease.</td>
</tr>
<tr>
<td>Canada</td>
<td>Heart and Stroke Foundation</td>
<td>Recommendation for healthy individuals is $300 \text{ mg of dietary cholesterol/day}$ with $&lt;7%$ of calories from SFA. People with heart disease or diabetes are advised to limit themselves to $200 \text{ mg of dietary cholesterol/day}$ with $&lt; 7%$ of calories from SFA.</td>
</tr>
<tr>
<td>Europe</td>
<td>European Society for Cardiology</td>
<td>The cholesterol intake in the diet should ideally be $&lt;300 \text{ mg/day}$</td>
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