Objectives

By the end of this session, participants will be able to:

• Identify sources of heart-healthy fats versus saturated fats

• Describe how soluble fiber may be beneficial for lowering cholesterol
Hyperlipidemia

https://watchlearnlive.heart.org/CVML_Player.php?moduleSelect=chlscr

<table>
<thead>
<tr>
<th>Total Cholesterol Level</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 200 mg/dL</td>
<td>Desirable</td>
</tr>
<tr>
<td>200-239 mg/dL</td>
<td>Borderline high</td>
</tr>
<tr>
<td>240 mg/dL and above</td>
<td>High</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>LDL Cholesterol Level</th>
<th>LDL Cholesterol Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 100 mg/dL</td>
<td>Optimal</td>
</tr>
<tr>
<td>100-129 mg/dL</td>
<td>Near optimal/above optimal</td>
</tr>
<tr>
<td>130-159 mg/dL</td>
<td>Borderline high</td>
</tr>
<tr>
<td>160-189 mg/dL</td>
<td>High</td>
</tr>
<tr>
<td>190 mg/dL and above</td>
<td>Very high</td>
</tr>
</tbody>
</table>

*Cholesterol levels are measured in milligrams (mg) of cholesterol per deciliter (dL) of blood.

A blood clot (thrombus) forms at the site of the plaque rupture.

Heart muscle (myocardium) supplied by the blocked artery starts to die.

Inflammatory cells (macrophages) engulf deposited cholesterol.

Muscle cells in the artery wall

Large unstable plaque with thin fibrous cap

Foam cells continue to expand the core of the plaque.
Medical Nutrition Therapy for Hyperlipidemia

• Dietary recommendations currently from:
  • 2013 AHA/ACC Guideline of Lifestyle Management to Reduce Cardiovascular Risk (Eckel et al. 2013)
  • National Lipid Association Recommendations for Patient-Centered Management of Dyslipidemia -- Parts 1 & 2 (Jacobson et al. 2015a and b)

• Dietary recommendations include:
  • Choose unsaturated fats over saturated and trans fats
    • Use non-tropical oils (canola, olive, avocado)
    • Eat plenty of fruits, vegetables, and whole grains
    • Include low-fat dairy, poultry, fish, legumes, unsalted nuts
    • Limit red meat, sodium, sugar-sweetened beverages (SSB), and sweets
THE FACTS ON FAT

The American Heart Association recommends replacing bad (saturated) fats with good (unsaturated) fats as part of a healthy eating pattern.

LOVE IT

UNSATURATED (POLY & MONO)

- Lowers rates of cardiovascular and all-cause mortality
- Lowers bad cholesterol & triglyceride levels
- Provides essential fats your body needs but can’t produce itself

LIMIT IT

SATURATED

- Increases risk of cardiovascular disease
- Raises bad cholesterol levels

LOSE IT

ARTIFICIAL TRANS FAT, HYDROGENATED OILS & TROPICAL OILS

- Increases risk of heart disease
- Raises bad cholesterol levels
Saturated Fats (SFAs)

- Increase LDL-cholesterol

  - NLA: SFA <7% of total energy intake
    - AHA/ACC: 5 – 6% intake

  - 2000 calorie/day diet:
    - 5 – 7% intake of saturated fats
      = 11 – 15 g/day
Replacing SFAs

Isocaloric substitution of SFA by equivalent energy from
- Trans fat (2%)
- MUFA (5%)
- PUFA (5%)
- Carbohydrates from refined starches/added sugars (5%)
- Carbohydrates from whole grains (5%)

Isocaloric substitution of carbohydrates from refined starches/added sugars by equivalent energy from
- Trans fat (2%)
- SFA (5%)
- MUFA (5%)
- PUFA (5%)
- Carbohydrates from whole grains (5%)

Li, Y., et al. 2015
Replacing SFAs

- Replacing SFA with PUFA reduces the occurrence of CHD events by 19%
- Each 5% greater intake of PUFA:
  - reduced CHD risk by 10%
  - decreased LCL-C by 10 mg/dL

Mozaffarian D, et al. 2010
# Replacing SFAs

**Table 4** Predicted effects of macronutrient replacement of dietary saturated fatty acids with PUFA, MUFA, and carbohydrate on lipoprotein lipids based on results from controlled feeding trials

<table>
<thead>
<tr>
<th>Dietary component</th>
<th>Predicted effects* on lipoprotein lipids of replacing 5% of energy from saturated fatty acids with 5% of energy from the specified dietary component, mg/dL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LDL-C</td>
</tr>
<tr>
<td>PUFA</td>
<td>-9.0</td>
</tr>
<tr>
<td>MUFA</td>
<td>-6.5</td>
</tr>
<tr>
<td>Carbohydrate</td>
<td>-6.0</td>
</tr>
</tbody>
</table>

HDL-C, high-density lipoprotein cholesterol; LDL-C, low-density lipoprotein cholesterol; MUFA, monounsaturated fatty acid; PUFA, polyunsaturated fatty acid; TG, triglyceride.

*Results are summarized from controlled feeding trials of subjects with average-to-mildly dyslipidemic baseline levels of lipoprotein lipids. Effects may be more pronounced in those with higher baseline values.


*Jacobson et al. 2015*
Finding SFAs on a Nutrition Label

- **Total fat is the combined amount of all fats** (SFA, MUFA, PUFA, and *trans*)

- **Only *trans* and saturated fats are required on the label**
## SFAs in Food & Drink

<table>
<thead>
<tr>
<th>Food/Beverage</th>
<th>Saturated fat (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ground beef (3 oz)</td>
<td>6.0</td>
</tr>
<tr>
<td>Regular cheddar cheese (1 oz)</td>
<td>6.0</td>
</tr>
<tr>
<td>Chicken thigh with skin</td>
<td>5.6</td>
</tr>
<tr>
<td>Whole milk (1 cup)</td>
<td>5.1</td>
</tr>
<tr>
<td>Coconut oil (1 tsp)</td>
<td>3.7</td>
</tr>
<tr>
<td>Cream (1 tbsp)</td>
<td>2.9</td>
</tr>
<tr>
<td>Butter (1 tsp)</td>
<td>2.4</td>
</tr>
<tr>
<td>Mayonnaise (1 tbsp)</td>
<td>1.6</td>
</tr>
<tr>
<td>Egg yolk (from 1 large egg)</td>
<td>1.6</td>
</tr>
<tr>
<td>Bacon (1 slice)</td>
<td>1.1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Food/Beverage</th>
<th>Saturated fat (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 serving Meat lasagna</td>
<td>22.6</td>
</tr>
<tr>
<td>Crispy Chicken Tender Salad (with Grilled Chicken)</td>
<td>18</td>
</tr>
<tr>
<td>Panera Bear Claw</td>
<td>15</td>
</tr>
<tr>
<td>Starbucks Snowman cookie</td>
<td>14</td>
</tr>
<tr>
<td>Subway Italian 6 in. (with cheese and mayo)</td>
<td>13</td>
</tr>
<tr>
<td>Biggby Mocha Mocha Latte 16 oz</td>
<td>7.6</td>
</tr>
<tr>
<td>9 Hershey’s Candy Cane Kisses</td>
<td>7</td>
</tr>
</tbody>
</table>
Coconut Oil – A Healthy Alternative?

• Studies cited suggesting health benefits
  • small in size
  • used animal models
  • used virgin coconut oil → differs from refined coconut oil that is available to the public

• At 92% SFA, coconut oil contains more SFAs than butter

• Diets high in coconut oil can raise LDL-C

• Coconut oil is not recommended as a healthy oil alternative to improve lipid levels

<table>
<thead>
<tr>
<th>Food</th>
<th>Saturated fat (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coconut oil (1 tsp)</td>
<td>3.7</td>
</tr>
<tr>
<td>Butter (1 tsp)</td>
<td>2.4</td>
</tr>
</tbody>
</table>

https://www.news-medical.net/health/Coconut-Oil-Health-Benefits.aspx
Trans Fats

• AHA/ACC and NLA: reduce trans fats/minimal trans fats

• Each 1% of energy coming from trans fats increases LDL-C by ~1.5 mg/dL
  • compared with carbohydrates, MUFAs, or PUFAs

• Found in stick margarine, commercially prepared fried foods, sweets such as pastries and cakes, and microwave popcorn

• Products labeled as trans fat free may have up to 0.5 g of trans fat per serving.

• FDA extended compliance date to Jan 1, 2020

Nutrition Facts

<table>
<thead>
<tr>
<th>Amount/serving</th>
<th>%DV*</th>
<th>Amount/serving</th>
<th>%DV*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Fat 8g</td>
<td>12%</td>
<td>Total Carb. 24g</td>
<td>8%</td>
</tr>
<tr>
<td>Sat. Fat 3g</td>
<td>16%</td>
<td>Fiber 1g</td>
<td>3%</td>
</tr>
<tr>
<td>Trans Fat 1.5g</td>
<td></td>
<td>Sugars 3g</td>
<td></td>
</tr>
<tr>
<td>Cholest. 10mg</td>
<td>4%</td>
<td>Protein 4g</td>
<td></td>
</tr>
<tr>
<td>Sodium 290mg</td>
<td>12%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Percent Daily Values (%DV) are based on a 2,000 calorie diet.

INGREDIENTS: Enriched Wheat Flour (Unbleached Wheat Flour, Malted Barley Flour, Niacin, Reduced Iron, Potassium Bromate), Thamline Mononitrile, Riboflavin, Folic Acid, Water, Vegetable Shortening (Partially Hydrogenated Soybean and Cottonseed Oils), Soybean Lecithin with Mono- and Diglycerides, Vitamin A Palmitate), Butter, Sugar. Contains 2% or less of: Leavening (Yeast, Baking Powder [Sodium Bicarbonate, Cornstarch, Sodium Aluminum Phosphate, Calcium Sulfate, Monocalcium Phosphate]), Non-Fat Dry Milk, Salt, Dough Conditioner (Wheat Flour, DATEM, Dextrose, Soybean Oil, Ascorbic Acid, L-Cysteine, Azodicarbonamide(ADA), Calcium Stearoyl-2 Lactylate, Enzymes), Eggs, Artificial Flavor, Preservatives (Calcium Propionate, Potassium Sorbate, Citric Acid).
Sources of Healthy Fats

POLYUNSATURATED FATS (PUFAS)

• Oils – soybean, corn, sunflower
• Tofu / Soybeans
• Fish – salmon, albacore tuna, trout, mackerel, herring
• Some nuts and seeds (walnut, sunflower, flaxseed)

MONOUNSATURATED FATS (MUFAS)

• Oils – olive, canola, peanut, sesame
• Avocado
• Peanut butter
• Most nuts and seeds

Omega-3 Fatty Acids

• High intake of omega-3 FAs is associated with lower rates of heart disease

• Omega-3 fatty acids include
  • alpha-linolenic acid (ALA)
  • eicosapantaenoic acid (EPA)
  • docosahexaenoic acid (DHA)

• NLA recommends: ALA intake of 0.6 – 1.2% of energy

• NLA recommends: two 3.5 – 4 oz servings of oily fish per week
  • equivalent to 250 – 500 mg of EPA and DHA

Omega-6 (n-6) and omega-3 (n-3) fatty acids comprise the two classes of essential fatty acids (EFA). The parent compounds of each class, linoleic acid (LA) and α-linolenic acid (ALA) (bold font), give rise to longer chain derivatives inside the body. Due to low efficiency of conversion of ALA to the long-chain omega-3 PUFA, eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA), it is recommended to obtain EPA and DHA from additional sources. Dietary sources of the different LC-PUFA are listed in the colored boxes (23).

https://lpi.oregonstate.edu/mic/other-nutrients/essential-fatty-acids
Adding Omega-3 Fatty Acids to the Diet

- Eat 3.5 – 4 oz of grilled, baked, broiled, or sautéed fish at least 2x/week
  - Fish/seafood high in omega-3 FA: salmon, pacific oysters, tuna, trout, mackerel (not king), herring, sardines, anchovies
  - Limit fish that is high in mercury – shark, swordfish, king mackerel, tilefish, orange roughy, and big-eye tuna

- Use canola or soybean oil (ALA)
- Use ground flaxseed or flaxseed oil (ALA)
- Add walnuts to salads or trail mix and walnut oil in salad dressing (ALA)
- Choose eggs that are labeled as high in omega-3 FA (DHA)

- NLA recommendation: Some individuals who avoid seafood may benefit from a fish oil supplement, if recommended by a clinician
  - Daily supplements can provide 1 – 4 g of EPA/DHA
Dietary Cholesterol
(are eggs good for you now?)

• AHA/ACC and NLA recommendation: < 200mg/day
  • Hyper-responders should limit to near 0 mg/day

• Foods high in cholesterol:
  • Egg yolks (limit to 2 – 4/week)
  • Shellfish – shrimp, crab, clams
  • Organ meats – heart, kidney, liver
  • Fried foods
  • Processed meats

Foods High in Cholesterol

Beef brain  Chicken liver  Egg yolk
Shrimps  Cheeseburger  Chicken legs

http://www.nutrientsreview.com/lipids/cholesterol.html
Medical Nutrition Therapy for Hyperlipidemia

• Choose unsaturated fats over saturated and trans fats
  • Use non-tropical oils (canola, olive, avocado)

• Eat plenty of fruits, vegetables, and whole grains
  • Include low-fat dairy, poultry, fish, legumes, unsalted nuts
  • Limit red meat, sodium, sugar-sweetened beverages (SSB), and sweets
Fiber

• Insoluble Fiber (Non-viscous)
  - Adds bulk to the stool to help you pass food easier through the digestive tract

• Soluble Fiber (Viscous)
  - Attracts water in the digestive tract to form a gel-like mass
  - Slows digestion--keeping you fuller for longer
  - NLA recommends 5 – 10 g/day (or more)

• For each 1 g increase in soluble fiber → 1.1 mg/dL decrease in LDL-C
Sources of Fiber

INSOLUBLE

• Vegetables – green beans, dark green leafy vegetables
• Fruit skins and root vegetable skins
• Berries
• Whole-wheat products
• Wheat bran
• Seeds and nuts

SOLUBLE

• Vegetables – asparagus, Brussels sprouts, sweet potatoes, turnips, carrots
• Fruits – apricots, mangoes, oranges, apples, pears
• Legumes – black beans, navy beans, kidney beans, peas
• Wheat – barley, oats, oat bran
• Ground flax seed
Finding Whole Grains on a Nutrition Label

• First ingredient: **100% whole grain or whole grain**

• **Whole grain can be any kind of grain** or a mixture of grains (wheat, oats, barley, buckwheat, etc.)

• **Multi grain** → contains multiple types of grains, but not necessarily all whole

• **Enriched grains** have been refined
  • with nutrients added back in
Tips for Increasing Fiber

• To prevent uncomfortable side effects, increase fiber intake slowly.
• Stay hydrated to prevent constipation and gas.
• Choose whole fruit instead of juice.
• Eat the skin on fruits and vegetables if possible.
• Choose whole grain cereals and bread.
• Increase intake of beans by adding to soups or salads.
• If it is difficult to get the recommended daily amount from food alone, fiber supplements such as Benefiber, Metamucil, or fiber gummies may be considered.
  • “Start low and go slow”

https://www.news-medical.net/health/The-Importance-of-Dietary-Fiber.aspx
Plant Sterols and Stanols

• NLA recommendation: Consumption of **2g/day** of plant sterols and stanols can decrease LDL-C by 4 – 10%

• Occur naturally in foods, but in small amounts.
  - vegetable oils, nuts, seeds, whole grains
  - The average American consumes 200 – 400 mg/day
  - X2 for vegans

• Fortified sources – margarine spreads, orange juice, cereal, breakfast bars, dietary supplements
  - 1 tbsp Benecol buttery spread = 70 calories, 0.5 g of plant stanols
  - 4 tbsp/day of Benecol = **280 calories**, 2 g of plant stanols
Medical Nutrition Therapy for Hyperlipidemia

• Choose unsaturated fats over saturated and trans fats
  • Use non-tropical oils (canola, olive, avocado)

• Eat plenty of fruits, vegetables, and whole grains

• Include low-fat dairy, poultry, fish, legumes, unsalted nuts

• Limit red meat, sodium, sugar-sweetened beverages (SSB), and sweets
Role of the Registered Dietitian

“Nutritional counseling and follow-up/monitoring by a registered dietitian nutritionist are recommended whenever possible to individualize patients’ cardioprotective dietary patterns and to promote long-term dietary adherence.” – NLA, 2015

<table>
<thead>
<tr>
<th>Chart 15 Recommendations for team-based collaborative care</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Recommendations</strong></td>
</tr>
<tr>
<td>Health care teams for optimal lipid and ASCVD risk management may include, where available: the patient; the patient’s primary health care provider; nurses; nurse practitioners; pharmacists; physician assistants; registered dietitian nutritionists, including certified diabetes educators in some practices; exercise specialists; social workers; community health workers; and licensed professional counselors, psychologists, and health educators.</td>
</tr>
<tr>
<td>Health care team members should coordinate care support among various team members, use evidence-based guidelines/recommendations for dyslipidemia management, establish a structured plan for monitoring patient progress, and provide patients with a variety of tools and resources to improve their own care.</td>
</tr>
<tr>
<td>Team-based collaborative care may be incorporated into the Patient Centered Medical Home as a strategy to address shortfalls in patient health care quality, access, continuity, and cost.</td>
</tr>
</tbody>
</table>
Heart-Healthy Dietary Patterns

- Dietary Approaches to Stop Hypertension (DASH) (AHA/ACC and NLA)

- USDA – Healthy U.S.-style (AHA/ACC and NLA)

- American Heart Association (AHA/ACC and NLA)

- Mediterranean style (NLA)

- Vegetarian/vegan (NLA)

The specific diet recommendation should be individualized and depend on the patient’s lifestyle, cultural beliefs, other health factors, and preferences.

https://www.hsph.harvard.edu/nutritionsource/healthy-eating-plate/
DASH Diet

<table>
<thead>
<tr>
<th>Food Group</th>
<th>Recommended servings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grains and grain products</td>
<td>4 – 8 / day</td>
</tr>
<tr>
<td>Vegetables</td>
<td>3 – 5 / day</td>
</tr>
<tr>
<td>Fruits</td>
<td>3 – 5 / day</td>
</tr>
<tr>
<td>Low-fat or fat-free dairy</td>
<td>2 – 3 / day</td>
</tr>
<tr>
<td>Lean meat, poultry, fish</td>
<td>3 – 6 oz / day</td>
</tr>
<tr>
<td>Nuts, seeds, and dry beans</td>
<td>3 – 5 / week</td>
</tr>
<tr>
<td>Fats and oils</td>
<td>1 – 3 / day</td>
</tr>
<tr>
<td>Sweets</td>
<td>3 – 5 or less / week</td>
</tr>
</tbody>
</table>

Additional Recommendations

- < 2300 mg of sodium/day
- Adequate calcium intake
- Adequate magnesium intake from food sources
- High potassium → 4700 mg/day
- 30 – 45 minutes of physical activity on most days
- Moderate alcohol
Mediterranean Diet

• No one definition of a Mediterranean diet

• Most interpretations have similar characteristics:
  • Daily use of fruits, vegetables, bread, cereals, potatoes, beans, nuts, and seeds
  • Olive oil
  • Low to moderate amounts of dairy, fish, and poultry
  • Very low amounts of red meat
  • Eggs consumed 0-4x/week
  • Wine is consumed in low to moderate amounts

• Moderate in fat (32-35% of total calories)
  • Higher in SFA than is recommended for many (9-10% of total calories)

• Found to improve cholesterol, triglycerides, blood pressure, and fasting blood glucose levels
Vegetarian / Vegan Diets

Semi-vegetarian  Pescatarian  Lacto-ovo vegetarian
Lacto-vegetarian  Ovo-vegetarian  Vegan

• Adopting a vegetarian or vegan diet can help improve hyperlipidemia
  • Generally low in saturated fat and high in fiber from whole grains, fruits, and vegetables
  • Cheese??

• Semi-vegetarianism, or only occasionally consuming meat, is associated with improved cholesterol levels and can be a good alternative for individuals who do not want to eliminate meat.
Lifestyle Recommendations

• Work towards a healthy weight (5 – 10% weight loss can be helpful)

• Aim for 30 minutes of physical activity on most days
  • 200 – 300 minutes of moderate-intensity physical activity per week can help decrease weight and lower LDL-C

• Limit alcohol consumption to 1 drink/day for women and 2 drinks/day for men
  • If you do not drink, it is not recommended to add red wine or any other form of alcohol

• Do not smoke

• Get the recommended amount of sleep each night (7 – 9 hours)

• Manage stress
Clinical algorithm for screening and management of elevated TG.

Figure 1  Clinical algorithm for screening and management of elevated TG. Adapted from Miller M, et al. Circulation. 2011;123:2292-2333. Special consideration for patients with initial TG ≥1000 mg/dL and chylomiconemia: recheck lipids in 2 weeks. When TG <500 mg/dL, diet may gradually be liberalized with monitoring. In addition to added sugars, some foods and beverages that are high in naturally occurring sugars, for example, honey and fruit juices, should be limited. EPA, eicosapentaenoic acid; DHA, docosahexaenoic acid; HDL-C, high-density lipoprotein cholesterol; LDL-C, low-density lipoprotein cholesterol; non-HDL-C, non-high-density lipoprotein cholesterol; SFA, saturated fatty acids; TG, triglyceride.
Patient Resources

- American Heart Association (AHA)
  - www.heart.org
  - Articles, infographics, healthy recipes

- Academy of Nutrition and Dietetics (AND)
  - www.eatright.org
  - Articles, tips, healthy recipes

- MHealthy
  - https://hr.umich.edu/benefits-wellness/health-well-being/mhealthy
  - Recipes, University-wide events and resources

- Mediterranean Diet:
  - https://oldwayspt.org/traditional-diets/mediterranean-diet
  - Tips sheets, grocery list

- DASH Diet:
  - https://www.nhlbi.nih.gov/health-topics/dash-eating-plan
  - General description of diet, calorie levels/food groups, links to recipes

- Vegetarian/Vegan:
  - https://vegetariannutrition.net/
  - Recipes and informational articles
Special Thanks to

Kate McManus, MPH, ATC, CSCS

for her contributions to this presentation
References


References


Tangney, C., Rosenson, R. (2018). Lipid Lowering with Diet or Dietary Supplements.. UpToDate


