Fats, Oils, Triglycerides
About which Americans seem confused
Learning Objectives

- Define fats and oils
- Understand triglycerides
- Consider the benefits of saturated fats
- Identify trans fats in your food supply
- Understand monounsaturated fats
- Become aware of the importance of Essential Fatty Acids (EFAs)
- Learn the difference between low-fat & high-fat diets
What is a fat? What is an oil?

Fats are lipids – solid at room temperature
Oils are lipids – liquid at room temperature
Both are TRIGLYCERIDE form
Intro to Triglycerides
Triglyceride Under a Microscope

Triglyceride
Triglycerides are Everywhere

- Oils and fats in the diet are triglyceride form
  - Butter & coconut oils
  - Olive & Avocado oils
  - Safflower & sunflower oils
  - Flax & fish oils
  - In fact, all oils and fats

- Fats in our blood and our fat cells are also triglyceride form
- They all provide 9 calories per gram
Triglycerides in Your Bloodstream

- **Step 1**
  - High Blood Sugar from eating too many carbs

- **Step 2**
  - Our liver takes the excess carbs from the bloodstream

- **Step 3**
  - Liver converts the excess carbs to triglycerides

- **Step 4**
  - Liver puts the new triglycerides back into the bloodstream
# Three Categories of Fats & Oils

<table>
<thead>
<tr>
<th>Saturated</th>
<th>Monounsaturated</th>
<th>Polyunsaturated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Butter/ghee</td>
<td>Olive oil</td>
<td>Omega 6 Sunflower</td>
</tr>
<tr>
<td>Coconut</td>
<td>Nut oils</td>
<td>Safflower</td>
</tr>
<tr>
<td>Animal fats</td>
<td>Avocado</td>
<td>Corn oil</td>
</tr>
<tr>
<td>Palm oil</td>
<td>Peanut oil</td>
<td>Soy oil</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Grape seed</td>
</tr>
<tr>
<td><strong>Can heat</strong></td>
<td><strong>Can heat</strong></td>
<td><strong>Do not heat</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sesame oil</td>
</tr>
</tbody>
</table>
Saturated Fats
Saturated Fats

- **Characteristics**
  - Solid at room temperature
  - “Saturated” with hydrogen atoms
  - Has been wrongly demonized
  - Your liver can make them from carbs
  - Mother's milk: 50% of its total fatty acids are saturated fat
  - The human brain is nearly 50% fat, a mix of saturated & polyunsaturated
    - Mayo Clinic study: those who ate the most sat fat had 36% risk reduction for dementia
  - Sat fats are NOT “bad” – our beliefs have been “influenced” since the 1950’s
Benefits of Saturated Fats

- Increase Total Cholesterol BUT
  - Increase HDL [good] more than LDL
  - Tends to change your LDL into “large fluffy” (better)
- Harvard study conclusion: Higher sat fat intake is associated with slower progression of atherosclerosis
- Every cell membrane is at least 50% sat fat → stability
- Sat fat lowers Lp(a) (risk factor for heart disease)
- MCT (coconut) sat fats → anti-microbial, protect the gut
Saturated Fats, con’t

<table>
<thead>
<tr>
<th>FAT</th>
<th>% SATURATED FATTY ACIDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coconut</td>
<td>86</td>
</tr>
<tr>
<td>Palm kernel</td>
<td>82</td>
</tr>
<tr>
<td>Cocoa butter</td>
<td>60</td>
</tr>
<tr>
<td>Butter</td>
<td>51</td>
</tr>
<tr>
<td>Beef tallow</td>
<td>50</td>
</tr>
<tr>
<td>Palm oil</td>
<td>49</td>
</tr>
<tr>
<td>Lard</td>
<td>39</td>
</tr>
<tr>
<td>Duck fat</td>
<td>33</td>
</tr>
<tr>
<td>Chicken fat</td>
<td>30</td>
</tr>
<tr>
<td>Cottonseed</td>
<td>26</td>
</tr>
<tr>
<td>Salmon oil</td>
<td>20</td>
</tr>
<tr>
<td>Peanut oil</td>
<td>17</td>
</tr>
<tr>
<td>Soybean oil</td>
<td>16</td>
</tr>
<tr>
<td>Olive oil</td>
<td>14</td>
</tr>
</tbody>
</table>

**TABLE 1.** Percent of fatty acids as saturated fatty acids in common fats and oils. Plant oils can be rich or poor in saturated fat, while animal fats tend to be intermediate.

**TABLE 2.** Saturated fat content as a percent of total calories in the American diet and selected traditional diets.² ³ ⁴

<table>
<thead>
<tr>
<th>DIET</th>
<th>% TOTAL CALORIES AS SATURATED FAT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard American</td>
<td>11</td>
</tr>
<tr>
<td>Inuit</td>
<td>10-12</td>
</tr>
<tr>
<td>Kitava</td>
<td>17</td>
</tr>
<tr>
<td>Pukapuka</td>
<td>30</td>
</tr>
<tr>
<td>Tokelau</td>
<td>49</td>
</tr>
</tbody>
</table>
Trans Fats

- Occur naturally in very small amounts in nature
- Now widely produced industrially from vegetable oils for use in:
  - Margarine & Crisco®
  - Packaged or fresh baked goods
  - Snack food
  - Frying for fast food
- Identify trans fats by the words “hydrogenated” or “partially hydrogenated”
- Consistently shown to be associated with coronary artery disease
- Avoid at all costs!
What about Cholesterol?

- Read *The Great Cholesterol Myth*
  - Stephen Sinatra MD & Johnny Bowden PhD
- Review of data from the Framingham Heart Study
  - Diet: the more saturated fat, the more cholesterol & the more calories one ate, the LOWER the rate of heart disease*
- Mother’s milk
  - has more cholesterol than almost any other food
- Cholesterol is not the bad guy! It travels in lipoprotein particles: LDL & HDL – avoid oxidized LDL

Benefits of Cholesterol

- Structure of cell membranes & communication pathways
- Building block for sex hormones, cortisol, vitamin D
- 25% of body cholesterol is in our brain – higher levels associated with better memory, longer life
- 2012 Norwegian study:
  - Lower cholesterol levels increase women’s risk for heart disease, cardiac arrest & stroke
  - Women with “high cholesterol” (> 270 mg/dl) had a 28% lower mortality risk than women with “low cholesterol” (< 183 mg/dl)
“The cholesterol you eat has a minimal effect on your blood levels of cholesterol”

-- Dr. Stephen Sinatra
Foods to Help Lower Cholesterol
(If you are still concerned)

- Legumes
- Soluble fibers
  - Oat bran
  - Gums: guar gum, acacia gum
- Bitter foods to help bile flow
- Artichoke (the herb)
- Fish oil   EPA + DHA ~ 1 g/day
- Garlic
- Curcumin (from turmeric)
Monounsaturated Fats
Monounsaturates – Good for your Heart

- **Sources**
  - Olive oil
  - Avocado oil
  - Peanut oil
  - Most nut oils
  - Wild salmon

- **Triglyceride form with one hydrogen missing in the fatty acid (1 double bond)**

- **High in the Mediterranean Diet**
- **Liquid at room temp only**
- **May gently heat in cooking**

Oleic acid, a monounsaturated fatty acid. Note that the double bond is *cis*; this is the common natural configuration.
Benefits of Monounsaturates

- AHA recommends to improve blood lipid profile
  - Increases HDL
  - Lowers LDL
- Reduces risk of heart disease
- Associated with fewer strokes
- Contributes to weight loss & reduction of belly fat
- Increases insulin sensitivity
- Protects vs. Metabolic Syndrome
- May reduce the risk of certain cancers
Polyunsaturated Fats
Review – Your EFAs

- **Omega 6**
  - Safflower oil
  - Sunflower oil
  - Soy oil
  - Corn oil
  - Grape seed oil
  - Sesame oil (half n6)

- **Omega 3**
  - Flax oil
  - Chia seed oil
  - Hemp seed oil
  - Fish oil
    - EPA
    - DHA
Essential Fatty Acids (EFAs)

- Both omega 6 & omega 3 are **ESSENTIAL FATTY ACIDS**
- Body Requirement – but cannot be “made” in the body
- Must be acquired from your diet
- Both are “polyunsaturates” . . . 2 - 6 double bonds
- Both go rancid much more easily than other fats

**NEVER HEAT THESE!**
Review: A Triglyceride
Sources of Omega 3 Oils

- ALA (fatty acid)
  - Flax oil
  - Chia seed oil
  - Hemp oil
  - Some in walnuts, pumpkin seeds, wheat germ
- EPA (fatty acid)
- DHA (fatty acid)

Anti-inflammatory
Benefits of Balanced EFAs

- Moist skin & hair (deficiency will cause dry skin)
- DHA essential for fetal development of retina, brain/nervous system
- Healthy cell membranes, arteries
- Reduces inflammation (joint pain, arthritis, autoimmune . . .)
- Anti-depressant activity
- Reduces risk of cognitive decline in elderly (more gray matter)
- Contributes to heart health
  - Lowers cholesterol, especially LDL
  - Lowers blood pressure
  - “Thinner” blood – omega 3 prevents clotting
  - High doses lower elevated triglycerides
Dangers of Omega 6 Oils

- “Vegetable oils”
- Go rancid easily → several double bonds
- Highly refined/processed → initial rancidity
- Heat (cooking) → further rancidity
- Commercially, may be “hydrogenated”
- Hydrogenated omega 6s = Trans fats
- Pro-inflammatory
- Rancid oils cause free radical damage & body aging

**OMEGA-6 FATTY ACIDS**

- Linoleic Acid (LA) (e.g. corn, safflower, sunflower oil)
- Gamma-Linolenic Acid (GLA) (e.g. evening primrose, borage, black currant seed oils)
- Dihomo-Gamma-Linolenic Acid (DGLA)
- PGE1 (anti-inflammatory)
- Delta-5 desaturase
- Arachidonic Acid (AA) (meat)
- Cyclooxygenase
- Lipoxigenase
- PGE2 (pro-inflammatory)
- LTB4 (pro-inflammatory)
Omega 6 : Omega 3 Ratio

- **Your ratio is important!**
  - Omega 6 **increases** inflammation
  - Omega 3 **reduces** inflammation
- Most Americans have 20 or 30 times more 6 than 3
  - Notice that most diseases of aging involve inflammation
- Most common sources of omega 6
  - Chicken (they eat corn)
  - Vegetable oils: corn, soy, safflower, sunflower, grape seed
- Healthy ratio: $\frac{2}{1}$ or $\frac{3}{1}$
  
  w6 : w3
Reading Fish Oil Labels

The 2 fatty acids from fish oils

**EPA**
- Anti-inflammatory
- Heart and artery health
- Anti-depressant

**DHA**
- Required in pregnancy & lactation
- Necessary for development of brain & retina in fetus
- Nervous System/Brain health

![Fish Oil Label](image)
Omega 3’s: Flax or Fish???

- Flax oil provides ALA (alpha linolenic acid)
- Fish oil provides EPA & DHA
- Human body can only minimally produce EPA & DHA from ALA
  - If diet is higher in sat fat, conversion may be 6% (EPA) and 3.8% (DHA)
  - If diet is higher in omega 6s, conversion is reduced by ~ half
EFAs for Vegetarians/Vegans

**Omega 6**
- Sources:
  - Safflower oil
  - Sunflower oil
  - Corn oil
  - Soy oil
  - Sesame oil
  - Walnuts
  - Hemp seeds

**Omega 3**
- **ALA**
  - Flax seeds/oil
  - Hemp seeds
  - Chia seeds
  - Walnuts
- **EPA, DHA**
  - Nordic Naturals’ Algae Omega
    - Both EPA & DHA
    - Low dose, however
Low Fat or High Fat?
What are the consequences?
Our Ancestors

Back on the farm:
Saturated fat & cholesterol
1950’s and Ancel Keys

- Researcher Ancel Keys proposed a **theory**: heart disease is caused by cholesterol and saturated fat
- Numerous studies found his conclusions faulty
- Key’s articles, however, were well publicized – who benefited?
  
  **The vegetable oil industry**

- U.S. butter consumption fell from 18#/year (1910) to 4#/year (1970)
- Vegetable oils/margarine/shortening consumption increased 400%
- Before 1920, Heart Disease was considered rare
- By the mid-50’s, CVD became the leading cause of death in Americans
The Low-Fat Scam

- If we reduce fat, we increase carbs
- Replacing fat in the diet with carbs:
  - Raises your triglycerides
  - Lowers your good HDL
  - Increases your insulin → insulin resistance: belly fat accumulates
- Since the 1950’s, diabetes rates have risen dramatically
  - 1958: .93% of population
  - 2015: 7.4% of population
Number and Percentage of U.S. Population with Diagnosed Diabetes, 1958-2015

Percentage with Diabetes

Number with Diabetes (Millions)

Year

Blood Sugar Issues & Heart Attacks

“We know that overt diabetes actually corrodes and destroys your microcirculation, your capillary network. That’s a predominant reason [for heart attacks]. We have millions of people living on high-carbohydrate diets, low-fat diets, which has an inflammatory effect on their microcirculation.”

-- Dr. Thomas Cowan, holistic MD
The Ketogenic Diet – High Fat!

- Used for epilepsy and now for reducing risk of dementia
- The Ketogenic Diet – the other extreme:
  - Very limited carbs: not more than ~ 50 g/day carb
  - Very high fat
  - Moderate protein
- Forces the cells to burn fat rather than glucose
- This produces “ketone bodies” that go into circulation
- Ketones feed the brain
- MUST be able to digest fats efficiently!
So: High Fat or Low Fat?

- Notes to self:
  - Fat is not the enemy
  - Quality matters (organic, not refined...)
  - Balance saturated, monounsaturated & EFAs in our meals
  - If we reduce fat, we increase carbs
  - Do not fall for “low fat” programs

Moderation in all things