Dietary Fats: The Good, the Bad, and the Ugly

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BIOGRAPHY:
Katie Ferraro is a Registered Dietitian, Certified Diabetes Educator, and an Assistant Clinical Professor of Nutrition at the UCSF School of Nursing and the School of Nursing at the University of San Diego. Katie specializes in nutrition education program and curriculum development and her professional areas of interest include diabetes education and dietary fiber. She is a Consultant Dietitian with the San Francisco Sheriff’s Department and the author of the forthcoming book “Diet Therapy for Advanced Practice Nurses” to be published by McGraw Hill later this year.
Overview

- Lipid is the chemical term for fat
- Lipids contribute texture, taste, mouthfeel, flavor & aroma to foods
- In body, fats pad body’s organs, insulate the body, form cell membranes
- Fats & oils = 9 kcal/gram
- Typical US diet: 33% kcals from fat

Lipid Classification

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
</table>
| Triglycerides | 95% of dietary fat comes from triglycerides  
| Phospholipids | Allow water & fats to mix  
| Sterols     | Form cholesterol, vitamin D, sex hormones, cortisol (stress hormone)       |

Dietary Fats: The Good, the Bad, the Ugly

- Saturated and *trans* fatty acids
- Unsaturated fatty acids
- Cholesterol
- Essential fatty acids
- Mediterranean diet
- Determining your own dietary fat needs
**Triglycerides**

- **Glycerol**
- **Fatty acids**
- **Triglyceride**

**Dietary Sources of Fat**
- Meat, fish, poultry, legumes, seeds, eggs, nuts
- Dairy products & condiments
- Coconuts & avocados
- Added fats: oil, butter, margarine

**Body Fat: Location, Location, Location**

**Research: Location of Body Fat**
- Health, Aging, and Body Composition Study
- 2,500 70-79 year olds
  - Those with more abdominal visceral fat had stiffer arteries than those with less
  - Didn’t matter whether they were normal weight, overweight or obese

Source: Hypertension 2001 Sep;38(3):429-33
Image: Jose Paolo S. Borromeo
Sources of Saturated Fats

Saturated fats are solid at room temperature
- Meat
- Cheese
- Full fat dairy, ice cream, butter
- Palm and coconut oils

Top Food Sources of Sat Fat, US

<table>
<thead>
<tr>
<th>Ranking</th>
<th>Food Item</th>
<th>Contribution to Intake (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Regular cheese</td>
<td>8.5</td>
</tr>
<tr>
<td>2</td>
<td>Pizza</td>
<td>5.9</td>
</tr>
<tr>
<td>3</td>
<td>Grain-based desserts</td>
<td>5.8</td>
</tr>
<tr>
<td>4</td>
<td>Dairy desserts</td>
<td>5.6</td>
</tr>
<tr>
<td>5</td>
<td>Chicken and chicken mixed dishes</td>
<td>5.5</td>
</tr>
<tr>
<td>6</td>
<td>Sausage, franks, bacon, and ribs</td>
<td>4.9</td>
</tr>
<tr>
<td>7</td>
<td>Burgers</td>
<td>4.4</td>
</tr>
<tr>
<td>8</td>
<td>Mexican mixed dishes</td>
<td>4.1</td>
</tr>
<tr>
<td>9</td>
<td>Beef and beef mixed dishes</td>
<td>4.1</td>
</tr>
<tr>
<td>10</td>
<td>Reduced fat milk</td>
<td>3.9</td>
</tr>
</tbody>
</table>

Source: National Cancer Institute, NHANES 2005-2006

Research: Meat & Heart Disease

- NIH-AARP Diet and Health Study "Meat intake and mortality: a prospective study of over half a million people"
- Most red meat (5 oz/day) were 30% more likely to die – of heart disease or cancer over next 10 years than those who ate the least red meat (2/3 ounce per day)
- Those who ate most white meat (poultry and fish) had a slightly lower risk of dying over a decade than those who ate the least

Message: Cut down/back on red/processed meats

USDA Definitions

- “Lean” cut steak or roast – no more than 10% fat
- “Extra lean” cut steak or roast – no more than 5% fat
- “Prime” beef is the fattiest – “select” is the leanest – “choice” is in the middle

Meat Matters

- Raw meat reduces by about 25% when cooked
- 4 oz serving of raw meat = 3 oz cooked meat

Poultry

- Fat: Thighs > wing > drumstick > breast
- Ground turkey or chicken may mean meat + skin
Remove Saturated Fat, Replace...

- Reducing saturated fat may have unintended consequence of increasing triglycerides
- If saturated fat is replaced with refined carbohydrates, triglycerides ↑
- Goal is to replace saturated fat calories with high-fiber, whole grains, fruits, vegetables and lentils to prevent ↑ triglycerides

Saturated Fat Recommendations

- Keep saturated fat to no more than 7-10% of total calories
- For 2,000 calorie diet, that is 16-22 grams per day
- US food labels, daily value based on 20 grams per day
Trans Fatty Acids

- Trans fatty acids can be created by hydrogenation.
- Hydrogenation causes some double bonds to become saturated.
- Hydrogenated fats are found in margarines, shortening & shelf-stable baked goods.
- Trans fatty acids ↑ LDL, ↓ HDL & ↑ cardiovascular disease risk.

Trans Fat 0.5g Loophole

- If a product has <0.5 g trans fat per serving, it can be labeled as trans fat free.
- Check label for partially hydrogenated oils.
Research: Trans Fat Ban

- NYC passed 2006 restriction on trans fat use in restaurants
- 2012, 168 randomly selected NYC locations of 11 fast food chains
- Interviewed customers in 2007 & 2009
- Analyzed 6,969 purchases in 2007 and 7,885 purchases in 2009
- Mean trans fat ↓ by 2.4 g; sat fat ↑ by 0.55 g; mean trans + sat fat ↓ by 1.9 g overall
**Monounsaturated Fats**
- Avocado
- Canola, olive, peanut, sesame oils
- Olives
- Peanut butter
- Sesame seeds
- Nuts

**Oils: Fatty Acid Profile**

![Image: Monounsaturated Fats]

**Research: Diets & Lipid Profiles**

2009, small study (n=18), 4 week maintenance phase of 3 diets:

<table>
<thead>
<tr>
<th>Diet</th>
<th>Category</th>
<th>Effect on LDL</th>
</tr>
</thead>
<tbody>
<tr>
<td>South Beach</td>
<td>Mediterranean, low-carb, high-pro</td>
<td>↓ 11.8%</td>
</tr>
<tr>
<td>Ornish</td>
<td>High-carb, low-fat</td>
<td>↓ 16.6%</td>
</tr>
<tr>
<td>Atkins</td>
<td>High-fat, high-pro, low-carb</td>
<td>↑ 8.1%</td>
</tr>
</tbody>
</table>

Brachial artery testing to measure flow-mediated vasodilation found an inverse correlation with intake of saturated fat.

![Image: Vegetable Oil]

![Image: Canola Oil]
**Cholesterol**

- Essential for human health
- Found in diet – but body also makes
- What about foods fried “cholesterol free oil”?

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**Omega-3 Fatty Acids**

- Group of polyunsaturated fatty acids
- Essential – must be obtained in the diet
- Component of cell membranes
- Mediate inflammation, regulate blood clotting and contraction/relaxation of arterial walls
- May be helpful in relieving symptoms in rheumatoid arthritis and age-related macular degeneration

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**Are Eggs “Bad” for Cholesterol?**

- Therapeutic Lifestyle Change (TLC) to lower cholesterol
- <200 mg/day cholesterol
- 1 egg has 186 mg cholesterol
- How many eggs/week ok?

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**Omega-3 Fatty Acids**

| ALA: alpha-linolenic acid | Vegetable oils: canola, soybean, flaxseed
|                          | Nuts (walnuts), flax
|                          | Brussels sprouts, kale, spinach, greens
|                          | Can be converted – in very small amounts – to EPA + DHA in the body
| EPA: eicosapentaenoic acid | EPA + DHA
|                          | Fatty fish: salmon, herring, mackerel, trout, sardines
| DHA: docosahexaenoic acid | DHA: brain development, nervous system

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Image: Jose Paolo S. Barrameda
AHA Omega-3 Recommendations

If no documented coronary heart disease:
- Eat fish at least 2 times (2 servings per week)
- Serving is 3.5 oz cooked, about ¾ cup flaked fish

If documented coronary heart disease:
- 1 gram per day of EPA + DHA
- Preferably from fatty fish but consider supplements

If ↑↑ triglycerides:
- May need 2-4 g/day EPA + DHA

EPA + DHA Content of Foods (6oz)

<table>
<thead>
<tr>
<th>Food</th>
<th>DHA + EPA (mg)</th>
<th>Food</th>
<th>DHA + EPA (mg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atlantic salmon, farmed</td>
<td>3,630</td>
<td>Sardines, veg oil (3 oz)</td>
<td>840</td>
</tr>
<tr>
<td>Atlantic salmon, wild</td>
<td>3,130</td>
<td>Halibut</td>
<td>790</td>
</tr>
<tr>
<td>Coho salmon, farmed</td>
<td>2,180</td>
<td>Rockfish</td>
<td>750</td>
</tr>
<tr>
<td>Coho salmon, wild</td>
<td>1,960</td>
<td>Ocean perch</td>
<td>640</td>
</tr>
<tr>
<td>Rainbow trout, farmed</td>
<td>1,880</td>
<td>Sardines, tomato sauce (3 oz)</td>
<td>630</td>
</tr>
<tr>
<td>Rainbow trout, wild</td>
<td>1,480</td>
<td>Boppack tuna, fresh</td>
<td>560</td>
</tr>
<tr>
<td>Sardines, tomato sauce (3 oz)</td>
<td>1,395</td>
<td>Pacific cod, yellowfin tuna</td>
<td>470</td>
</tr>
<tr>
<td>Bumble Bee Salmon (3 oz)</td>
<td>1,200</td>
<td>Blue crab (3 oz)</td>
<td>400</td>
</tr>
<tr>
<td>Sardines, corn oil (3 oz)</td>
<td>1,190</td>
<td>Curtis, wild or Haddock</td>
<td>400</td>
</tr>
<tr>
<td>Pacific oyster (3 oz)</td>
<td>1,170</td>
<td>Chicken-set Pink Salmon (3 oz)</td>
<td>360</td>
</tr>
<tr>
<td>Rainbow trout</td>
<td>850</td>
<td>Shrimp (3 oz)</td>
<td>270</td>
</tr>
</tbody>
</table>


Research: Fish Oil Pills & CVD

- 2012, double-blind, 2-by-2 factorial design
- n=12,536 at high risk for CVD events or had IFG/IGT or diabetes
- Randomized to 1-g capsule with 900 mg n-3 fatty acids or placebo and to insulin glargine or standard care
- Primary outcome: death from CVD, 6.2 yr f/u

Research: Fish Oil Pills & CVD (cont.)

- 9.1% in n-3 group & 9.3% in placebo group died of cardiovascular causes
- Virtually no difference between intervention & control for stroke, heart attack, death from arrhythmia or heart-failure hospitalization
- Triglycerides were significantly lower in control
- Researchers speculate: patients on heart meds in study may have masked n-3 benefits

Research: Fish Oil & Dementia

- Previous research: n-3 protect against cognitive decline (DHA role on brain)
- Cochrane review, 3,536 people from 3 high quality clinical trials
- Results show no benefit for cognitive function with omega-3 PUFA supplementation among cognitively healthy older people
- Might have other benefits, heart health?

Omega-6 Fatty Acids

- Essential polyunsaturated fatty acids
- Lower LDL cholesterol
- Reduce inflammation
- Protect against heart disease
- Intake usually adequate due to vegetable oil intake
- Goal: shift ratio omega-3 ↑ and omega-6 ↓

"Excellent" Source of Omega-

Dr. Ancel Keys

- 1904-2004
- University of Minnesota
- WWII infamous “K ration”
- Post-WWII “Biology of Human Starvation” (1950)
- Seven Countries Study
**Research: The 7 Countries Study**

- 1958-1970, men 40-59 in 18 areas of 7 countries
- First to explore associations among diet, risk & disease in contrasting populations
- Chemical analysis of foods + diet recall
- Demonstrated degree to which the diet – and in particular saturated fatty acids and cholesterol levels – predict present and future CAD

**Principles of the Med Diet**

- Plant-based diet with herbs & spices for flavor
- Limited red meat intake, focus on fish & poultry
- Low processed food intake, emphasizes fresh
- Includes foods from the sea
- Moderate dairy and wine
- Activity is part of a healthy lifestyle
- Focus on good fats: olive oil

**Med Diet: Focus on Fats**

- Total fat is 25-35% of calories
- Saturated fat is no more than 7-8% of calories
- Olive oil, nuts, seeds
- Limited animal foods
- Monounsaturated fats are not alone protective against CVD, but lifestyle + foods together are
California Avocado, 1/5 fruit, raw

**Nutrition Facts**

- **Serving Size**: 30 g
- **Calories**: 90
- **Calories from Fat**: 35%

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Amount Per Serving</th>
<th>% Daily Value*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calories</td>
<td>90</td>
<td></td>
</tr>
<tr>
<td>Total Fat</td>
<td>10 g</td>
<td>7%</td>
</tr>
<tr>
<td>Saturated Fat</td>
<td>1 g</td>
<td>7%</td>
</tr>
<tr>
<td>Trans Fat</td>
<td>0 g</td>
<td>0%</td>
</tr>
<tr>
<td>Cholesterol</td>
<td>0 mg</td>
<td>0%</td>
</tr>
<tr>
<td>Sodium</td>
<td>39 mg</td>
<td>1%</td>
</tr>
<tr>
<td>Total Carbohydrate</td>
<td>17 g</td>
<td>5%</td>
</tr>
<tr>
<td>Dietary Fiber</td>
<td>2 g</td>
<td>8%</td>
</tr>
<tr>
<td>Sugars</td>
<td>0 g</td>
<td>0%</td>
</tr>
<tr>
<td>Protein</td>
<td>1 g</td>
<td>2%</td>
</tr>
<tr>
<td>Vitamin A</td>
<td>1% + Vitamin C</td>
<td>4%</td>
</tr>
<tr>
<td>Calcium</td>
<td>0% + Iron</td>
<td>1%</td>
</tr>
</tbody>
</table>

Nutrient values are based on a 2,000 calorie diet. Your needs may be higher or lower depending on your calorie needs.

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**Med Diet: Focus on Alcohol**

- Moderate consumption of wine
- Normally consumed with meals
- Moderation defined as:
  - No more than 1 glass wine per day for women
  - 1-2 glasses wine per day for men

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**Research: PREDIMED vs. Low-Fat**

- PREDIMED Prevención con Dieta Mediterránea
- N=722 asymptomatic persons, 55-80 at high CVD risk, randomized to low-fat or 1 of 2 Med diets
- After 3 months follow-up:
  - Weight/BMI same in 3 groups
  - Lower BG, lower systolic BP, lower t-chol/HDL ratios in 2 Med diet groups than low-fat
  - Inflammation markers also lower in 2 Med diets


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**Research: Metabolic Syndrome**

- 2011, Meta-Analysis of 50 studies and 534,906 individuals
- Effect of Mediterranean diet on metabolic syndrome and its components
- Adherence to Mediterranean diet was “highly protective”
- Showed 31% lower risk of developing metabolic syndrome

*J Am Coll Cardiol. 2011;57(11):1299-1313*
Research: Heart Disease

- n=7447 enrolled, aged 55-80, 57% female
- Smokers, overweight, diabetes or risk factors
- Low fat diet group or 1 of 2 Med diet groups
- Meaningful endpoints: MI, stroke, death
- Findings: 30% of MI, stroke, death can be prevented if switch to Mediterranean diet

TLC Diet: Does it Work?

<table>
<thead>
<tr>
<th>Change</th>
<th>LDL Reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Saturated fat &lt;7%</td>
<td>8-10%</td>
</tr>
<tr>
<td>&lt;200 mg/day</td>
<td>3-5%</td>
</tr>
<tr>
<td>Lose 10 pounds if</td>
<td>5-8%</td>
</tr>
<tr>
<td>Overweight</td>
<td></td>
</tr>
<tr>
<td>Add 5-10 grams/day</td>
<td>3-5%</td>
</tr>
<tr>
<td>Add 2 grams/day</td>
<td>5-15%</td>
</tr>
<tr>
<td>Total</td>
<td>20-30%</td>
</tr>
</tbody>
</table>

Therapeutic Lifestyle Change Diet

- Saturated fat <7% total calories
- Fat 25-35% total calories
- Cholesterol <200 mg per day
- Sodium <2,400 mg per day
- Calories Just enough to reach or maintain healthy wt

Determining Lipid Needs

AMDR: 20-35% kcal from fat
American Heart Recs: < 30% total kcals from fat for heart health
† ratio of unsaturated to saturated fats
< 10% kcal from saturated fat (<20 grams)
0-1% kcal from trans fats

Can calculate your calorie needs here: [http://www.nhlbi.nih.gov/cgi-bin/cho/step2intro/cgi](http://www.nhlbi.nih.gov/cgi-bin/cho/step2intro/cgi)
Application: Lipid Needs

- 64 year old male, status post heart attack
- His daily estimated kcal needs are 2,200 kcal/day
- Healthcare professional recommends no more than 20% of kcal from fat
- What is the maximum number of fat grams per day that he should be eating with this Rx?

Application: Solution

- Question is asking you maximum number of grams of fat per day
- 20% of 2,200 calories should come from fat
- $2,200 \times 0.2 = 440$ kcal from fat
- Question doesn’t ask you kcal from fat – asks you about grams
- $440\ \text{kcal from fat} \div 9\ \text{kcal/g} = 49\ \text{grams fat}$

Your Nutrition Prescription

For a healthy person on 2,000 calorie diet/day:

- 65 grams total fat
- <20 grams saturated fat
- 0 grams trans fat
- <200 mg dietary cholesterol

Meet the Fats

American Heart Association "Meet the Fats":
http://www.heart.org/HEARTORG/GettingHealthy/FatsAndOils/MeettheFats/Meet-the-Fats_UCM_304495_Article.jsp
For More Information

- MedlinePlus, Fat:  
- CDC, Nutrition for Everyone, Dietary Fat:  
  [www.cdc.gov/nutrition/everyone/basics/fat/index.html](http://www.cdc.gov/nutrition/everyone/basics/fat/index.html)
- FAO, Fats and oils in human nutrition:  

For More Information

- Harvard Omega-3 Fatty Acids:  
  [http://www.hsph.harvard.edu/nutritionsource/omega-3-fats/](http://www.hsph.harvard.edu/nutritionsource/omega-3-fats/)
- NCCAM Omega-3 Supplements:  
- Office of Dietary Supplements Omega-3 Fatty Acids Working Group Report:  

For More Information

- American Heart Association Fats 101:  
  [http://www.heart.org/HEARTORG/GettingHealthy/FatsAndOils/Fats-101_UCM_304494_Article.jsp](http://www.heart.org/HEARTORG/GettingHealthy/FatsAndOils/Fats-101_UCM_304494_Article.jsp)
- American Heart Association My Fat Translator:  
  [http://www.heart.org/HEARTORG/GettingHealthy/FatsAndOils/Fats101/My-Fats-Translator_UCM_428869_Article.jsp](http://www.heart.org/HEARTORG/GettingHealthy/FatsAndOils/Fats101/My-Fats-Translator_UCM_428869_Article.jsp)
- WHO Global atlas on cardiovascular disease prevention and control:  
- Harvard Fats and Cholesterol: Out with the Bad...  

For More Information

- University of Minnesota The Seven Countries Study in Brief:  
  [http://www.sph.umn.edu/epi/history/overview/](http://www.sph.umn.edu/epi/history/overview/)
- Oldways What is the Mediterranean Diet?  
- American Heart Association Mediterranean Diet:  
  [http://www.heart.org/HEARTORG/GettingHealthy/NutritionCenter/Mediterranean-Diet_UCM_306004_Article.jsp](http://www.heart.org/HEARTORG/GettingHealthy/NutritionCenter/Mediterranean-Diet_UCM_306004_Article.jsp)