Therapeutic Lifestyle Changes
Primary Learning Objectives

• Describe effective diet and lifestyle strategies for long-term obesity and dyslipidemia management

• Describe the association of specific dietary patterns such as increased sodium and sugar intake, and the increased risk for cardiovascular disease associated morbidity and mortality.

• Compose a clinical care plan for reducing risk of CVD in patients with dyslipidemia
Presentation Outline

Part 1: Summary of 2013 ACC/AHA Lifestyle Recommendations

Part 2: Impact of Dietary Patterns and Macronutrients on Lipids

Part 3: Impact of Exercise on Lipids

Part 4: Practical Approach to Weight Loss

Part 5: Effect of Nutritional Supplements on Lipids
2013 AHA/ACC Guideline on Lifestyle Management to Reduce Cardiovascular Risk
A Report from the ACC/AHA Task Force on Practice Guidelines

Endorsed by the American Association of Cardiovascular and Pulmonary Rehabilitation, American Pharmacists Association, American Society for Nutrition, American Society for Preventive Cardiology, American Society of Hypertension, Association of Black Cardiologists, Preventive Cardiovascular Nurses Association, and WomenHeart: The National Coalition for Women with Heart Disease

2013 ACC/AHA Lifestyle Guideline

• Critical Questions
  – CQ1: Among adults, what is the effect of dietary patterns and macronutrient composition on CVD risk factors?
  – CQ2: Among adults, what is the effect of dietary intake of sodium and potassium on CVD risk factors?
  – CQ3: Among adults, what is the effect of physical activity on BP and lipids?

2013 ACC/AHA Lifestyle Guideline: Dietary Pattern and Lipids

- Advise adults who would benefit from LDL-C lowering to:
  - 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 (IA)
  - Aim for dietary pattern that achieves 5-6% of calories from saturated fat (IA)
  - Reduce percent of calories from saturated fat (IA)
  - Reduce percent of calories from trans fat (IA)

2013 ACC/AHA Lifestyle Guideline: Dietary Pattern and BP

- Advise adults who would benefit from BP lowering to:
  - 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 (IA)
  - Lower sodium intake (IA)
  - Consume no more than 2400 mg of sodium/day (IIaB)
  - Combine the DASH dietary pattern with lower sodium intake (IA)

2013 ACC/AHA Lifestyle Guideline: Physical Activity

• For Lipids (to reduce LDL-C and non-HDL-C) and BP
  – In general, advise adults to engage in aerobic physical activity to reduce LDL-C and non-HDL-C 3-4 sessions a week lasting on average 40 min per session and involving moderate to vigorous intensity (IIaA)
Part 2

The Impact of Dietary Patterns and Macronutrients on Lipids
2013 ACC/AHA Lifestyle Guideline: Dietary Pattern and Lipids

• Advise adults who would benefit from LDL-C lowering to:
  – 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 (IA)
  – Aim for dietary pattern that achieves 5-6% of calories from saturated fat (IA)
  – Reduce percent of calories from saturated fat (IA)
  – Reduce percent of calories from trans fat (IA)

### 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 or 1 egg]</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>

Prevalence of DASH Style Diet is Low in US

• In 1999 to 2004, only 19.4% of hypertensive US adults were following a DASH-type diet (based on intake of fiber, magnesium, calcium, sodium, potassium, protein, total fat, saturated fat, and cholesterol).

• This represented a decrease from 26.7% of hypertensive US adults in 1988 to 1994.

2011 AHA Heart Disease and Stroke Statistical Update, Circulation 2012
DASH Diet and Lipids

• As compared to typical 1990’s American diet, DASH diet
  – Lowered LDL-C by 11 mg/dl
  – Lowered HDL-C by 4 mg/dl
  – Had no effect on triglycerides
  – Changes similar in all subgroups

  – Strength of Evidence: Low

DASH Diet Variations and Lipids

• Modifying DASH diet by replacing 10% of carbohydrates with same amount of protein
  – Lowered LDL-C an additional 3 mg/dl
  – Lowered HDL-C by an additional 1 mg/dl
  – Lowered triglycerides by 15 mg/dl

• Modifying DASH diet by replacing 10% of carbohydrates with same amount unsaturated fat
  – Led to no additional LDL lowering
  – Lowered HDL-C by an additional 1 mg/dl
  – Lowered triglycerides by 10 mg/dl

Mediterranean Diet: PREDIMED Trial

- 7447 Spanish men and women without h/o CVD with h/o either T2DM or at least 3 traditional risk factors
- Randomized to
  - 1) Med Diet + extra virgin olive oil
  - 2) Med Diet + nuts
  - 3) low fat diet
- Results – Med diets led to fewer CV events than low-fat diet with no difference in mortality
- Caveat – Subjects randomized to Med diets were given free provisions of olive oil or nuts

• Advise adults who would benefit from LDL-C lowering to:
  – 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 (IA)
  – Aim for dietary pattern that achieves 5-6% of calories from saturated fat (IA)
  – Reduce percent of calories from saturated fat (IA)
  – Reduce percent of calories from trans fat (IA)
“Need to Know” Info Regarding the Effects of Various MacroNutrients on Lipid Parameters

- Dietary Cholesterol
- Fats
  - Saturated
  - Trans
  - MUFA
  - PUFA

MUFA = monounsaturated fatty acids
PUFA = polyunsaturated fatty acids
Dietary Education 101 for Patients

• CHOLESTEROL
  – Always in animals
  – Only in animals
  – Never in plants

2013 ACC/AHA Guidelines:
“There is insufficient evidence to determine whether lowering dietary cholesterol reduces LDL-C”

**Cholesterol Absorption**

- Most of cholesterol absorbed in upper part of small intestine at the brush border
- **Diet:** Approximately 200-300 mg/day
- Mixed micelle
  - Dietary fat
    - Monoglycerides
    - Fatty acids
    - Phospholipids (biliary lecithin)
    - Cholesterol
- **Bile acid reabsorption:** 600 mg/day
- **Total:** Approximately 800 mg/day reabsorbed intestinal cholesterol to hepatic cholesterol
Dietary Education 101 for Patients

• FATS
  – Different types of fat affect blood cholesterol differently
  – All fats have same effect on weight
  – OIL = FAT (regardless of type)

Should We Concentrate on Amount of Total Fat or the Type of Fat?
NCEP ATP III Recommends Avoiding High and Low Fat Intakes

• Avoid very high fat intake
  – Can lead to excess calories → obesity
  – Difficult to meet SFA goal
  – Concerns about some cancers

• Avoid very low fat intake
  – Poor compliance
  – low HDL-C and high TG

SFA = saturated fatty acids
Trans Fatty Acids (TFAs)

Trans Fat
(i.e., trans fatty acids)

\[
\begin{array}{c}
\text{H} \\
\text{H} \\
\text{-C=C-} \\
\text{H}
\end{array}
\]

Hydrogen atoms are on opposite sides of the chain of carbon atoms at the carbon-carbon double bond.

Adapted from http://www.cfsan.fda.gov/~dms/qatrans2.html#s1q2
TFAs

- Facts About TFA
  - More densely packed than the *cis* mono fatty acids
  - ~ 2-3 % of energy intake is TFA

- If TFA Are Consumed in High Amounts
  - ↑ LDL-C
  - ↓ HDL-C

- Major Sources of Dietary TFA
  - Baked goods (cookies, donuts, biscuits, pies)
  - Snack foods (crackers, chips)
  - Stick margarine, shortening (fries, fried foods)
Effect of Reducing TFAs on Lipids

In controlled feeding trials, for every 1% of energy from TFAs replaced by similar amount of

- **MUFA**
  - LDL-C lowered by 1.5 mg/dl
  - HDL-C raised by 0.4 mg/dl
  - Triglycerides lowered by 1.2 mg/dl

- **PUFA**
  - LDL-C lowered by 2.0 mg/dl
  - HDL-C raised by 0.5 mg/dl
  - Triglycerides lowered by 1.3 mg/dl

Level of Evidence: Moderate

Types of Saturated Fat

- Lauric acid (12:0)
- Myristic acid (14:0)
- Palmitic acid (16:0)
- Stearic acid (18:0)*

*Effect is neutral as it is converted to monounsaturated fat in the body

Current intake of saturated fat in US
= 11% of calories

http://www.cfsan.fda.gov/~dms/qatrans2.html#s1q2
Saturated Fat and Lipids

As compared to control diet, limiting saturated fat to 5-6% of calories
• Lowered LDL-C by 11-13 mg/dl without significant effect on other lipid parameters

(Strength of Evidence: High)

Mono-Unsaturated Fatty Acids (MUFAs)

- National dietary guidelines increasingly recommend MUFAs*
- Consumption of MUFA
  - Promotes healthy lipid profiles
  - Mediates blood pressure
  - Improves insulin sensitivity
  - Regulates glucose levels
  
* Enhancing MUFA intakes up to 25% of energy

Poly-Unsaturated Fatty Acids (PUFAs)

- Fatty acids that contain more than one double bond in their backbone
- Some omega 3 (linoleic acid) and omega 6 (linolenic acid) are ‘Essential’ in diet since mammals lack ability to add double bonds in fatty acids beyond carbon 9 and 10
Omega-3 Fatty Acids

- Named for Placement of the 1st Double Bond
  - Favorably affect platelet function
  - ↓ TG
  - Can ↑ LDL-C in combined hyperlipidemia
  - Associated with ↓ sudden death

- **Marine:**
  - Eicosapentaenoic Acid (EPA) C20:5
  - Docosahexaenoic Acid (DHA) C22:6

- **Plant:**
  - Linolenic Acid (C18:3;N-3)
## AHA Science Advisory 2002: Summary for Omega-3 Fatty Acids

<table>
<thead>
<tr>
<th>Population</th>
<th>Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patients without documented CHD</td>
<td>Eat a variety of (preferably oily) fish at least 2X a week. Include oils and foods rich in α-linolenic acid (flaxseed, canola, soybean oils; flaxseeds and walnuts)</td>
</tr>
<tr>
<td>Patients with documented CHD</td>
<td>Consume ~ 1g of EPA+DHA per day, preferably from oily fish. EPA+DHA supplements could be considered in consultation with physician</td>
</tr>
<tr>
<td>Patients needing triglyceride lowering</td>
<td>Two to four grams of EPA+DHA per day provided as capsules under a physician’s care</td>
</tr>
</tbody>
</table>
# Content of EPA + DHA (mg/3 oz serving) in 37 Commonly Consumed Types of Fish

<table>
<thead>
<tr>
<th>Fish Type</th>
<th>EPA + DHA (mg/3 oz)</th>
</tr>
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<tbody>
<tr>
<td>Orange Roughy</td>
<td>26</td>
</tr>
<tr>
<td>Tilapia</td>
<td>115</td>
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<tr>
<td>Mahi-Mahi</td>
<td>118</td>
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<tr>
<td>Cod</td>
<td>134</td>
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<tr>
<td>Catfish (farmed)</td>
<td>151</td>
</tr>
<tr>
<td>Catfish (wild)</td>
<td>201</td>
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<tr>
<td>Lt. Chunk Tuna</td>
<td>230</td>
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<tr>
<td>Yellowfin Tuna</td>
<td>237</td>
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<tr>
<td>Clams</td>
<td>241</td>
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<tr>
<td>Mixed Shrimp</td>
<td>267</td>
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<tr>
<td>Skipjack Tuna</td>
<td>278</td>
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<tr>
<td>Scallops</td>
<td>310</td>
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<tr>
<td>Dungeness Crab</td>
<td>335</td>
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<tr>
<td>Walleye</td>
<td>338</td>
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<tr>
<td>King Crab</td>
<td>351</td>
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<tr>
<td>Oysters (farmed)</td>
<td>374</td>
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<tr>
<td>Halibut</td>
<td>395</td>
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<tr>
<td>Blue Crab</td>
<td>403</td>
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<tr>
<td>Flat Fish</td>
<td>426</td>
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<tr>
<td>Pollock</td>
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<tr>
<td>Sea Bass</td>
<td>648</td>
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<td>Swordfish</td>
<td>696</td>
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<tr>
<td>Shark (raw)</td>
<td>711</td>
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<tr>
<td>White Tuna</td>
<td>733</td>
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<tr>
<td>Sardines</td>
<td>835</td>
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<tr>
<td>Coho Salmon (wild)</td>
<td>900</td>
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<tr>
<td>Rainbow Trout (farmed)</td>
<td>981</td>
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<tr>
<td>Chum Salmon (canned)</td>
<td>999</td>
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<tr>
<td>Mackerel (canned)</td>
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<tr>
<td>Sockeye Salmon (wild)</td>
<td>1046</td>
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<tr>
<td>Coho Salmon (farmed)</td>
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<tr>
<td>Pink Salmon (wild)</td>
<td>1094</td>
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<td>Bluefin Tuna</td>
<td>1279</td>
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<td>Atlantic Salmon (wild)</td>
<td>1564</td>
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<tr>
<td>Atlantic Salmon (farmed)</td>
<td>1825</td>
</tr>
</tbody>
</table>

Effect of Dietary MUFA and PUFA on Lipids

In controlled feeding trials for every 1% of energy from carbohydrates replaced by similar amount of

• MUFA
  • LDL-C lowered by 0.3 mg/dl
  • HDL-C raised by 0.3 mg/dl
  • Triglycerides lowered by 1.7 mg/dl

• PUFA
  • LDL-C lowered by 0.7 mg/dl
  • HDL-C raised by 0.2 mg/dl
  • Triglycerides lowered by 2.3 mg/dl

Level of Evidence: Moderate

Part 3

The Impact of Exercise on Lipids
Physical Activity (PA) in the United States

• PA is difficult to measure, therefore it is difficult to assess changes in the population over time

• According to recent estimates:
  – Although 26.2% of adults in the USA report being physically active (>30 min) on most days of the week\(^1\)
  – When PA was measured by a device that detects movement, only 3-5% of adults obtained ±30 min of moderate or greater intensity PA ≥5 days/week\(^2\)
    • Males more active than females
  – 40% of adults report no leisure time physical activity (probably an underestimate)\(^3\)


PA = Physical Activity
Effect of Physical Activity on Lipids

• Aerobic
  – Reduces LDL-C by 3.0-6.0 mg/dl
  – Reduces non-HDL-C by 6 mg/dl
  – No consistent effect on HDL-C or triglycerides

• Resistance Training
  – Reduces LDL-C by 6-9 mg/dl
  – Reduces non-HDL-C by 6-9 mg/dl
  – Reduces triglycerides by 6-9 mg/dl
  – No consistent effect on HDL-C
Exercise and Lipids: Dose Response

• Study: overweight adults with mild-moderate dyslipidemia; 84 randomized to 1 of 3 treatment groups
• Results:
  – More exercise improved more lipid variables than lower amounts, e.g., improved lipid triad, not LDL-C
    • Small, dense LDL
    • HDL-C
    • TG
  – Both lower-amount exercise groups always had better responses than the control group
• Conclusions:
  – The highest amount of weekly exercise, with minimal weight change, had widespread beneficial effects on the lipoprotein profile.
  – The improvements were related to the amount of activity and not to the intensity of exercise or improvement in fitness.

Increasing Physical Activity Significantly Reduces Abdominal Adipose Tissue and Improves Insulin Sensitivity *Without Significant Changes in Body Weight and/or BMI*

Moderate vs. Vigorous Exercise

✔ Health care professionals who work with high CMR patients should have an understanding of what activities constitute moderate and vigorous physical activity

✔ Prediabetic, metabolic syndrome, obese, and diabetic patients will almost exclusively require activities in the moderate intensity range (i.e., 40-60% of aerobic capacity) and in many cases lower intensity activities

✔ When you definitively recommend (in writing or personal verbal instruction) activities in the vigorous intensity range requiring >60% of aerobic capacity, factor this into the ACSM decision tree for pre-exercise program screening and possible GXT evaluation

ACSM = American College of Sports Medicine
CMR = Cardiometabolic Risk
GXT = Graded Exercise Test
American College of Sports Medicine Recommendations for Persons With Dyslipidemia*

**Primary activity:** aerobic exercise

**Intensity:** 40-75% aerobic capacity

**Frequency:** 5 or more days a week

**Duration:** 30-60 minutes

* This amount of physical activity is consistent with recommendations for [long-term weight control](#) (200-300 minutes/wk mod. PA or ≥2,000 kcal/wk). This may be accumulated with repeated exercise bouts of ≥10 minutes.

2013 ACC/AHA Summary
Recommendations for Exercise

• In general, advise adults to engage in aerobic physical activity to reduce LDL-C and non-HDL-C:
  – 3-4 sessions per week  
  – 40 minutes per session  
  – Moderate to vigorous in intensity

Strategies for Exercise

- Specific counseling advice such as a detailed exercise prescription may help\(^1\)
  - Frequency
  - Intensity
  - Time (duration)
  - Use acronym FIT with patients
- Suggest incorporating lifestyle activities
  - Climbing stairs
  - Walking
  - Gardening
  - Housework
- View as ongoing process in behavioral change\(^2\)


FIT = Frequency Intensity Time
Part 4

Practical Approach to Weight Loss
200-300 kcal Increase in Mean Caloric Intake in U.S. Since 1970’s (Mostly carbohydrates)

http://www.cdc.gov.revproxy.brown.edu/nchs/data/hus/hus05.pdf#027
NIH Overall Goals of Weight Loss

Reduce Body Weight in the Short-term
Maintain a Lower Body Weight for the Long Term
Prevent Further Weight Gain – Minimum Goal

Rate of Weight Loss
• 10% reduction in body weight in 6 months of therapy
• Rate is 1-2 lb per week

Maintenance of Weight
• Requires regular physical activity

NDEP Caloric Targets for Steady Sustained Weight Loss

Overweight/Obese Patient Often Have Unrealistic Expectations and Goals for Weight Loss

<table>
<thead>
<tr>
<th>Current Weight</th>
<th>Calories and Fat</th>
</tr>
</thead>
<tbody>
<tr>
<td>120 – 170 pounds</td>
<td>1,200 calories/day</td>
</tr>
<tr>
<td>175 – 215 pounds</td>
<td>1,500 calories/day</td>
</tr>
<tr>
<td>220 – 245 pounds</td>
<td>1,800 calories/day</td>
</tr>
<tr>
<td>250 – 300 pounds</td>
<td>2000 calories/day</td>
</tr>
</tbody>
</table>

Adapted from [www.ndep.nih.gov/campaigns/SmallSteps/gameplan/gp_booklet.htm#overview](http://www.ndep.nih.gov/campaigns/SmallSteps/gameplan/gp_booklet.htm#overview)
Exercise or Caloric Restriction for Weight Loss: Achieving 300 kcal Negative Energy Balance

Reduce intake by:
- Eliminating 2 oz potato chips
- Substituting 2 diet sodas for 2 regular sodas

Or increase activity by:
- Running 3 miles in 30 min
- Bicycling 8 miles in 30 min
Common Weight Loss Diets

- Low CHO, High Protein, High Fat Diets

- Low Fat, High CHO

- Mediterranean Diet

Does the macronutrient profile affect weight loss?
Weight Changes During 2 years According to Diet Group (n = 227)

• 2 year study of three diets:
  – Low fat diet (calorie restricted)
  – Mediterranean diet (calorie restricted)
  – Low carbohydrate diet (not calorie restricted)

• The low-carbohydrate diet provided more protein and fat, and perhaps was associated with greater satiety, seemed to be more beneficial in terms of weight loss.

• There were initial weight losses in the early months, but

• Weight crept back up over time in all groups

POUNDS Lost Trial: Diets

These diets with target nutrient levels:
1. Low fat (20%), average protein (15%), highest carbohydrate (65%)
2. Low fat (20%), high protein (25%), carbohydrate (55%)
3. High fat (40%), average protein (15%), carbohydrate (45%)
4. High fat (40%), high protein (25%), lowest carbohydrate (35%)

Similar foods used for all diets but in different proportions
All dietary approaches adhered to healthful guidelines to prevent cardiovascular disease

POUNDS = Preventing Overweight Using Novel Dietary Strategies

POUNDS Diet
Prevention of Obesity Using Novel Dietary Strategies
Completers, N=645

- Weight and Waist Circumference Change 2 years
  - 20 or 40% fat
  - 15 or 25% protein
  - 65, 55, 45 or 35% Carbohydrate

- At 6 months, participants assigned to each diet had lost an average of 6 kg, which represented 7% of their initial weight; they began to regain weight after 12 months.

- By 2 years, weight loss remained similar in those who were assigned to any diet

- In general, trends in weight loss favored the high protein diet

- Satiety, hunger, satisfaction with the diet

- Attendance at group sessions was strongly associated with weight loss (0.2 kg per session attended)

A to Z Trial: Comparison of Four Popular Diets on Weight Loss

• 4 diets—3 popular and substantially different diets and 1 diet based on national guidelines—representing a spectrum of carbohydrate intake
  – Atkins8 (very low in carbohydrate)
  – Zone9 (low in carbohydrate)
  – LEARN18 (Lifestyle, Exercise, Attitudes, Relationships, and Nutrition; low in fat, high in carbohydrate, based on national guidelines), and
  – Ornish19 (very high in carbohydrate)

A to Z Trial: Comparison of Four Popular Diets on Weight Loss

• Primary objective was to examine the effects of diets and gradations of carbohydrate intake on weight loss and related metabolic variables in overweight and obese premenopausal women

• Results:
  – Weight loss was greater in the Atkins diet group compared at 12 months
  – Weight loss was not statistically different among the Zone, LEARN, and Ornish groups
  – At 12 months, secondary outcomes for the Atkins group were comparable with or more favorable than the other diet groups

Breakfast Makeover: Replace Simple Carbohydrates with Fiber, MUFA/PUFA

Original Breakfast

- 12 oz café mocha
  - 270 Calories
- Blue Berry Muffin 120 g
  - 460 calories
- 16 oz juice
  - 204 calories

= 934 cal

Breakfast Makeover

- Coffee with 2 oz skim milk
  - 40 calories
- 2 medium slices of Turkey bacon
  - 80 calories
- 1 small Bran muffin (66g)
  - 180 calories
- small banana
  - 120 calories

= 420 cal
NWCR Database: Behaviors Associated With Successful Long-Term Weight Management

- Characteristics of NWCR members
  - 78% eat breakfast every day
  - 75% weigh themselves at least once/week
  - 62% watch less than 10 hr TV/week
  - 90% exercise, on average about 1 h/day

NWCR = National Weight Control Registry

Practical Approach to Maximize Satiety and Achieve Meaningful Weight Loss and Weight Management

1. Individualized balance of Carbs / Fats / Protein for sustained adherence—Focus on FOOD
   - Right Fats (mono- and poly- unsaturated, omega 3’s)
   - Right Carbs (high fiber, low glycemic index, complex)
   - Right Protein (plant, marine, and lean animal sources)

2. Limit or eliminate sugar, high fructose corn syrup, and refined starches and snack foods

3. Reduce or eliminate all calories from beverages

4. Smaller portions, low energy density, high nutrient density

5. Consider book-keeping of calories, points, etc

6. Drink (and eat) water

7. Exercise for life

8. Get adequate sleep
More Intensive Approaches to Managing Energy (Caloric) Balance

• Very low calorie diets (800-1200 calories)
  – Commonly employed at ‘weight loss centers’
  – Often include use of meal replacements
  – Require careful laboratory monitoring and vitamin supplementation
  – Should be used only under strict medical supervision
  – Maintenance phase, rather than initiation phase, most important in picking a plan

• Weight loss medications
  – Sibutramine, phentermine, and orlistat all approved for weight loss
  – Each can be associated with significant tolerability issues and risk of adverse events
  – Other medications have been used off label

• Bariatric Surgery
  – Indicated for BMI $\geq 40$ kg/m$^2$ or $\geq 35$ kg/m$^2$ in setting of significant co-morbidities
Part 5

The Effect of Nutritional Supplements on Lipids
Antioxidant Vitamins for the Prevention of CVD

• Meta-Analysis of 7 Trials of Vitamin E
  – Dose range: 50-800 IU
  – 81,788 subjects
  – No effect on mortality

• Meta-Analysis of 8 Trials of Beta-Carotene
  – Dose range 15-50 mg
  – Small increase in all-cause mortality

Alcohol and CHD

• There is a “U-shaped” curve
  – One drink lowers CHD risk vs. risk in teetotalers
  – Increasing amounts lead to increasing total mortality

• No difference between red and white wine in ecological, epidemiological studies
  – Resveratrol in red wine may → CV benefits via ↓ LDL oxidation, ↑ nitric acid, or by changes in thrombogenicity, ischemia, or vascular tone¹

• Observational data
  Alcohol intake may be causally related to lower risk of CHD through changes in lipids (HDL-C, Apo AI, TG) and hemostatic factors²

If You Consume Alcohol, Do So in Moderation

Relative risk alcohol consumption and the risk of CHD

One drink equals:
• 12 oz beer
• 4 oz wine
• 1.5 oz 80 proof spirits

10 g alcohol equates to:
• 1 shot liquor
• 1 regular can beer
• 1 glass table wine

• 1 drink/day females
• 2 drink/day males

• With meals

Smoking Cessation

• Raises HDL-C
• Decreases CV risk
Plant Sterols

- Occur naturally
- Are structurally similar to cholesterol
- ~150-400 mg/d provided by typical western diet
- Higher intakes (1-3 g/d) are needed to ↓ atherogenic lipoproteins
- >40 (also called phytosterols) identified
  - Most common: sitosterol, campesterol & stigmasterol
- Have been identified in cholesterol plaque
  - Unclear significance
Plant Stanols

• Similar to sterols but have no double bonds
  – i.e., they are saturated sterols

• Less abundant in foods than sterols

• Most common stanols found naturally are sitostanol and campestanol

• Not found in cholesterol plaque
Plant Sterols/Stanols

- **Efficacy**
  - ~2 g/d of plant sterols/stanols is equivalent to ~3.3 g/d of sterol or stanol esters and associated with mean ↓ LDL-C of 13.1 mg/dL\(^1,2\)
  - Can lower LDL-C by 10-15%
  - TG and HDL-C are generally unchanged
  - LDL-C lowering may be greater in older adults
  - No fat malabsorption\(^3,4\)

Stanols vs. Sterols
Summary of Clinical Trial Data

• In 27 studies testing a mean dose of 2.5 g/d stanols, LDL-C decreased 10.1%
  – 4.0% LDL-C reduction per gram

• In 21 studies testing a mean dose of 2.3 g/d sterols, LDL-C decreased 9.7%
  – 4.2% LDL-C reduction per gram

Viscous Fibers for Lowering Atherogenic Lipoproteins

- TC, LDL-C, Apo B, and non-HDL-C are lowered by viscous fibers\(^1\)
- Insufficient evidence available to determine if the type of viscous fiber has a material impact on clinical response
- Meta-analysis from 55 studies of oat fiber, psyllium, pectin, and guar gum indicates that each gram of viscous fiber in the “practical” range of 2-10 g/d → \(\downarrow 1.7\) mg/dL in LDL-C\(^2\)
- Adding 5-10 g/d of viscous fiber to the diet would be expected to → \(\downarrow\) LDL-C by \(~6.5\)-13%

Apo B = apolipoprotein B

1. FDA. 2008.
Foods Containing Viscous Fibers

- Oats
- Barley
- Legumes
- Prunes
- Apples
- Some whole grain breads
Viscous Dietary Fiber Supplements

• Usual daily dose: 10-25 g/d
• Not all fiber laxatives contain ingredients proven to lower cholesterol, so patients should be provided with a list of such products.)
• Examples of fibers which ↓ atherogenic lipoproteins:
  – Psyllium (*Plantago avata*) seeds
  – Beta-glucan from oats and barley
  – Pectin (found in many fruits)
  – Guar gum
  – Modified cellulose fibers
    (e.g., hydroxypropylmethylcellulose)
  – Glucomannan
Effect of a Dietary Portfolio of Cholesterol Lowering Foods vs. Lovastatin on Serum Lipids and CRP

- **Design**: Randomized controlled trial
- **Who**: 46 healthy hyperlipidemic adults
  - 25 men
  - 21 postmenopausal women
- **Methods**: Compared control diet, control diet plus lovastatin 20 mg/day, and dietary portfolio

Interventions in Dietary Portfolio Study

1. Control Diet
   – Very low in saturated fat
   – Whole wheat cereals
   – Low-fat dairy foods

2. Control Diet + Lovastatin 20 mg/day

3. Portfolio Diet (high in 4 components)
   – Plant sterols (1 g/1000 kcal)
   – Soy protein (21.4 g/1000 kcal)
   – Viscous fibers (9.8 g/1000 kcal)
   – Almonds (14 g/1000 kcal)

Results of Portfolio Diet: Lipids and CRP


\[ aP < 0.05, \ bP < 0.01, \ cP < 0.001 \]
Omega-3 Polyunsaturated Fat Supplements

• Types:
  – Eicosapentaenoic acid (EPA): fish-based
  – Docosahexaenoic acid (DHA): fish-based
  – Alpha-linolenic acid (ALA): plant-based

• Clinical Indications for EPA and DHA Supplements:
  – Post-MI: 1 gram/day (AHA recommendation)
    • May be reconsidered after other studies were not able to replicate (? Effect of baseline dietary intake and statin use)
  – Severe Hypertriglyceridemia: much higher doses required (including prescription strength)
  – Clinical trial data demonstrating reduction of CV events with high dose omega 3s in patients with high triglycerides are lacking

## Omega 3’s Hypothetical Effects

<table>
<thead>
<tr>
<th>Effect</th>
<th>Relative Dose</th>
<th>Time Course</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anti-Arrhythmic</td>
<td>High</td>
<td>Weeks</td>
</tr>
<tr>
<td>Triglyceride Lowering</td>
<td>Moderate-High</td>
<td>Months</td>
</tr>
<tr>
<td>Heart Rate Lowering</td>
<td>Moderate</td>
<td>Months</td>
</tr>
<tr>
<td>Anti-Thrombotic</td>
<td>Low</td>
<td>Days - Weeks</td>
</tr>
</tbody>
</table>

Adapted from Mozaffarian, D. et al. JAMA 2006;296:1885-1899.
Summary
Essential Components of TLC for LDL-C

- Decrease consumption of saturated fats and trans fatty acid
- Increase dietary intake of MUFA and PUFA
- Increased dietary and supplemental fiber
  - High-fiber breakfast cereals, supplements, and so forth
- Plant sterols and stanols (2 g/d)
  - Spreads, pills, or combined with aspirin
- Soy protein
- Flavonoids (nuts)
- Weight loss
- Exercise
Essential Components of TLC for HDL-C and TGs

- Weight loss and exercise are key components
- Lower TG
  - Consume low-carbohydrate/sugar diet
    - Avoid sugar, high-fructose corn syrup, simple starches
  - Avoid excess fat in diet
  - Add omega-3 supplements
- Raise HDL-C
  - Exercise
  - Stop smoking
  - Moderate alcohol intake (1-2 glasses of red wine/d)
Resources

• AHA
  • Fat Calculator - http://www.myfatstranslator.com/
  • Healthy Lifestyle Page - http://www.americanheart.org/presenter.jhtml?identifier=1200009
  • AHA – My Life Check ™ - http://mylifecheck.heart.org/

• NHLBI

• ADA
  • Find a Registered Dietitian - http://www.eatright.org/cps/rde/xchg/ada/hs.xsl/index.html

• USDA/HHS

ADA = American Dietetic Association; HHS = Health and Human Services