Therapeutic Lifestyle Changes

Primary Learning Objectives

- Describe effective diet and lifestyle strategies for long-term management of obesity and dyslipidemia
- Describe the association of specific dietary components and patterns with both an increased risk, and a reduced risk, for cardiovascular disease events.
- Compose a clinical lifestyle care plan for reducing CVD risk in patients with dyslipidemia

Background

- Data from INTERHEART, MRFIT, and the NHS suggest that ≥80% of cardiovascular events can be attributed to potentially modifiable or preventable risk factors[1-3]

INTERHEART = A Study Of Risk Factors For First Myocardial Infarction In 52 Countries And Over 27,000 Subjects,
MRFIT = Multiple Risk Factor Intervention Trial,
NHS = Nurses Health Study

1. Yusuf S, et al. *Lancet.* 2004;364:937-952.
2. Stamler J, et al. *JAMA.* 2000;284:311-318.
3. Hu FB, et al. *N Eng J Med.* 1997;337:1491-1499.
4. Robinson JG, et al. *J Am Coll Cardiol.* 2005;46:1855-1862.

Presentation Outline

Part 1: Summary of 2013 ACC/AHA Lifestyle Recommendations, the NLA Part 2 Recommendations, and the 2015 Dietary Guidelines for Americans

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

Eckel RH, et al. Circulation 2014; Supplement July

NATIONAL LIPID ASSOCIATION

NLA Recommendations for Patient-Centered Management of Dyslipidemia

Part 2

J Clin Lipidol 2015; 9: S1 – S122

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)

Eckel RH, et al. Circulation 2014; Supplement July 1, 2014

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 patter 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)

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

National Heart, Lung, and Blood Institute. *Your Guide to Lowering Your Blood Pressure with DASH.* Bethesda, MD: National Heart, Lung, and Blood Institute, National Institutes of Health; 1998, rev 2006. NIH Publication No. 06-4082.
Available at: http://www.nhlbi.nih.gov/health/public/heart/hbp/dash/new_dash.pdf

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

Eckel RH, et al. Circulation 2013; published online November12, 2013

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

Eckel RH, et al. Circulation 2013; published online November12, 2013

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

Estruch R et al, N Eng J Med, 2013;368:1279-90

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 patter 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)

2015-2020 Dietary Guidelines for Americans

- **Key recommendations**:
    1. Follow a healthy eating pattern
    2. This pattern focuses on: vegetables, whole fruits, grains, fat-free/low fat diary, and protein (lean meat, seafood, poultry, eggs, nuts/seeds, soy)
    3. This pattern reduces saturated and trans fat, sugar and sodium
    4. Saturated fat < 10% of total calories
    5. Sugar < 10% of total calories
    6. Sodium < 2300 mg/day
    7. Specific dietary patterns examples given : Mediterranean and vegetarian

www.health.gov/dietaryguidelines

Dietary Education 101 for Patients

- CHOLESTEROL
  - Always in animals
  - Only in animals
  - Never in plants

2013 ACC/AHA Guidelines and 2015 Dietary Guidelines for Americans:

"There is insufficient evidence to determine whether lowering dietary cholesterol intake reduces LDL-C"

Dietary Education 101 for Patients

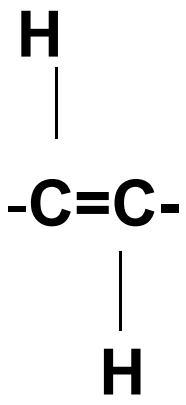
- FATS
  - Different types of fat affect blood cholesterol differently
  - All fats have same effect on weight
  - OIL = FAT (regardless of type)

Should We Concentrate on Amount of Total Fat or the Type of Fat?

Trans Fatty Acids (TFAs)

Trans Fat

(i.e., *trans* fatty acids)



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

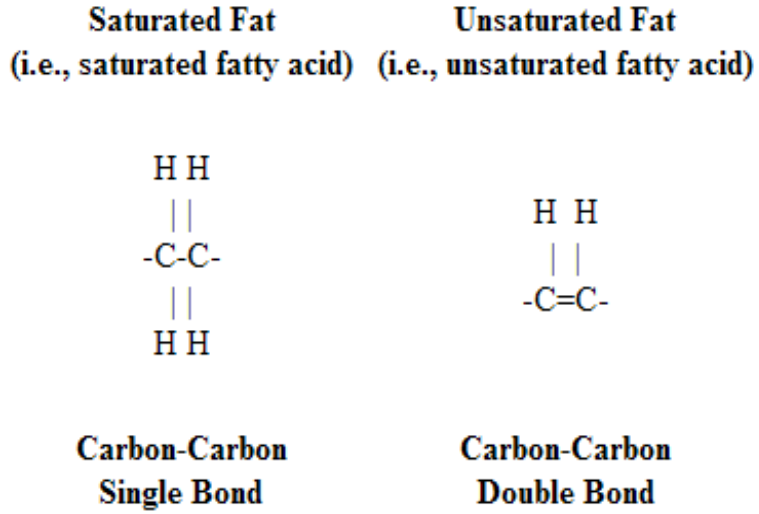
- MUFA
  - LDL-C lowered by 1.5 mg/dl
  - HDL-C raised by 0.4 mg/dl
  - Triglycerides lowered by 1.2 mg/dl
- PUFA
  - LDL-C lowered by 2.0 mg/dl
  - HDL-C raised by 0.5 mg/dl
  - Triglycerides lowered by 1.3 mg/dl

Level of Evidence: Moderate

Eckel RH, et al. Circulation 2014; Supplement July 1, 2014

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)

Eckel RH, et al. Circulation 2014; Supplement july 1, 2014

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

Gillingham LG, et al. *Lipids.* 2011;46:209-228.
American Heart Assoc. *Circulation.* 2010;121:e46-e215.
US Dept of Agriculture 2010 http://www.cnpp.usda.gov/dietaryguidelines.htm
Kris-Etherton PM, et al. *J Am Diet Assoc.* 2007;107:1599-1611.
FAO/WHO 2010 http://www.fao.org/ag/agn/nutrition/docs

Poly-Unsaturated Fatty Acids (PUFAs)

- Fatty acids that contain more than one double bond in their backbone
- Some omega 3 (alpha-linolenic acid) and omega 6 (linoleic 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:
  - α-Linolenic Acid (C18:3;N-3)

Content of EPA + DHA (mg/3 oz serving) in 37 Commonly Consumed Types of Fish

Orange Roughy	26
Tilapia	115
Mahi-Mahi	118
Cod	134
Catfish (farmed)	151
Catfish (wild)	201
Lt. Chunk Tuna	230
Yellowfin Tuna	237
Clams	241
Mixed Shrimp	267
Skipjack Tuna	278
Scallops	310
Dungeness Crab	335
Walleye	338
King Crab	351
Oysters (farmed)	374
Halibut	395
Blue Crab	403
Flat Fish	426
Pollock	460
Sea Bass	648
Swordfish	696
Shark (raw)	711
White Tuna	733
Sardines	835
Coho Salmon (wild)	900
Rainbow Trout (farmed)	981
Chum Salmon (canned)	999
Mackerel (canned)	1046
Sockeye Salmon (wild)	1046
Coho Salmon (farmed)	1087
Pink Salmon (wild)	1094
Bluefin Tuna	1279
Atlantic Salmon (wild)	1564
Atlantic Salmon (farmed)	1825

Harris WS, et al. *Curr Atheroscler Rep*. 2008;10:503-509.

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

Eckel RH, et al. Circulation 2014; Supplement July 1.2014

NLA Lifestyle Therapies: Nutrition

- The National Lipid Association (NLA) Expert Panel supports a cardioprotective eating pattern for the management of dyslipidemia and overall cardiovascular health that includes **<7% of energy from saturated fat, with minimal intake of *trans* fatty acids** to lower levels of atherogenic cholesterol (low-density lipoprotein cholesterol [LDL-C] and non-high-density lipoprotein cholesterol [non-HDL-C]).

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

- There are individuals who are hyper-responders to dietary cholesterol because of genetic or other reasons. For known or suspected hyper-responders, further reduction in dietary cholesterol beyond the <200 mg/day that is recommended as part of the cardioprotective eating pattern for the management of dyslipidemia may be considered. Consumption of very low intakes of dietary cholesterol (near 0 mg/day) may be helpful for such individuals.

NLA Lifestyle Therapies: Nutrition

- The NLA Expert Panel recommends any of the following **healthy dietary patterns, including an emphasis on a variety of plant foods and lean sources of protein** for managing dyslipidemia: Dietary Approaches to Stop Hypertension (DASH), United States Department of Agriculture (USDA) (healthy U.S.-style), American Heart Association (AHA), Mediterranean-style, and vegetarian/vegan. However, the dietary pattern should be individualized based on the patient's specific dyslipidemia. Also, patients' cultural and food preferences are important for guiding food selection to maximize dietary adherence. Nutritional counseling and follow-up/monitoring by a registered dietitian nutritionist is recommended whenever possible to individualize a patient's dietary pattern. Nutrition therapy should be included in those with other medical conditions, including diabetes.

- **If alcohol is consumed as part of a healthy dietary pattern, this should be in moderation** (≤7 drinks per week for women and ≤14 drinks per week for men; consumed in a non-binge pattern). One drink is equivalent to 12 oz. beer, 5 oz. wine, or 1.5 oz. distilled spirits.

NLA Lifestyle Therapies: Nutrition

- **Dietary saturated fat may be partially replaced with unsaturated fats (mono- and polyunsaturated fats),** as well as proteins, to reach a goal of <7% of energy from saturated fats. This can be achieved, in part, by incorporating foods high in unsaturated fats, such as liquid vegetable oils and vegetable oil spreads, nuts and seeds, as well as lean protein foods, such as legumes, seafood, lean meats, and non- or low-fat dairy products, into the diet as replacements for foods high in saturated fats.

- **Weight loss of 5-10% body weight is generally recommended for overweight or obese individuals** to lower atherogenic lipoprotein lipids and improve other atherosclerotic cardiovascular disease (ASCVD) risk factors. A variety of dietary approaches can be implemented for weight loss. Any dietary approach will result in weight loss if energy intake is reduced. An energy-reduced healthy dietary pattern that meets nutrient needs is recommended for patients who are overweight or obese. Several healthy dietary patterns, such as the Mediterranean-style, DASH, USDA, and vegetarian diets, can be tailored to personal and cultural food preferences and appropriate calorie needs for weight control.

NLA Lifestyle Therapies: Nutrition

- Eating patterns that contain a moderate quantity of carbohydrate, lower glycemic index and load, and higher protein, have been associated with modest benefits for weight loss and maintenance.

- **Plant sterols and stanols (~2 g/day) are recommended for cholesterol lowering, as well as viscous fibers (5 to 10 g/day or even greater, if acceptable to the patient), as adjuncts to other lifestyle changes**. However, individuals with phytosterolemia (sitosterolemia) should avoid foods that are fortified with stanols and sterols.

- **For patients with triglyceride (TG) levels ≥150 mg/dL, lifestyle therapy is indicated, including weight loss, if overweight or obese, physical activity, and restriction of alcohol, and sugars and refined starches**. Partial replacement of sugars and refined starches with a combination of unsaturated fats, proteins, and high-fiber foods may help to reduce TG and non-HDL-C concentrations.

NLA Lifestyle Therapies: Nutrition

- **For patients with TG levels ≥1000 mg/dL (and selected patients with TG 500-999 mg/dL), a low-fat diet (<15% of energy) and alcohol abstinence are recommended initially to minimize chylomicronemia**. In patients with hypertriglyceridemia and diabetes, dietary carbohydrate should not be substantially increased to avoid worsening glycemia when reducing fat intake. Medium-chain TG oil may be used as a source of energy that will not induce chylomicron production. For patients without lipoprotein lipase deficiency, dietary fat may be liberalized with monitoring of the TG response once the TG concentration is <500 mg/dL.

- **Therapeutic dosages of eicosapentaenoic acid (EPA) + docosahexaenoic acid (DHA) for TG reduction are 2.0 to 4.0 g/day. Use of these dosages of long-chain omega-3 fatty acids for TG-lowering should be done only under the supervision of a qualified clinician**. Clinicians are encouraged to educate patients on the importance of the amount of EPA + DHA in each capsule of dietary supplement or prescription products, and to take the appropriate number of capsules daily to achieve therapeutic levels. At present, prescription forms of EPA and EPA + DHA concentrates are only indicated for treatment of very high TG (≥500 mg/dL) to reduce the risk of pancreatitis.

NLA Lifestyle Therapies: Nutrition

- For primary and secondary prevention of ASCVD, consuming ≥2 servings/week of fish/seafood (preferably oily) is recommended. One serving is equal to 3.5 to 4 oz. and should ideally not be prepared using deep-frying.

- For patients with known ASCVD, suggestive, but not conclusive, evidence from randomized controlled trials is available for a benefit of long-chain omega-3 fatty acid supplementation at ~1 g/day EPA + DHA on cardiac mortality, but not non-fatal ASCVD events. EPA + DHA supplements may be considered for such patients, especially those who do not consume the recommended intakes of EPA + DHA from dietary sources.

- For patients with heart failure, 1 g/day of EPA + DHA is recommended as an adjunct to heart failure therapy.

- An alpha-linolenic acid intake of 0.6 to 1.2% of energy is recommended.

NLA Lifestyle Therapies: Nutrition

- **Consumption of at least three 1-oz. equivalent servings per day of fiber-rich whole grains is recommended**.

- **Consumption of ≥4 servings/week (1 oz. per serving) of nuts (including the legume, peanuts) is recommended**, because nut consumption has been consistently associated with reduced ASCVD risk. Nuts may be included in the diet as a protein food and as a source of healthy fat (predominantly unsaturated fatty acids).

- **Soy protein foods are one source of plant protein, among others** (e.g., nuts, legumes), that may be used as a substitute for protein foods high in saturated fat as part of a cardioprotective eating pattern.

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]

1. Manson JE, et al. *Arch Intern Med*. 2004;164:249-258.
2. Troiano RP, et al. *Med Sci Sports Exerc*. 2008; 40:181-188.
3. www.winl.niddk.nih.gov/statidstics/index.htm. Accessed 04/11/2010.

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

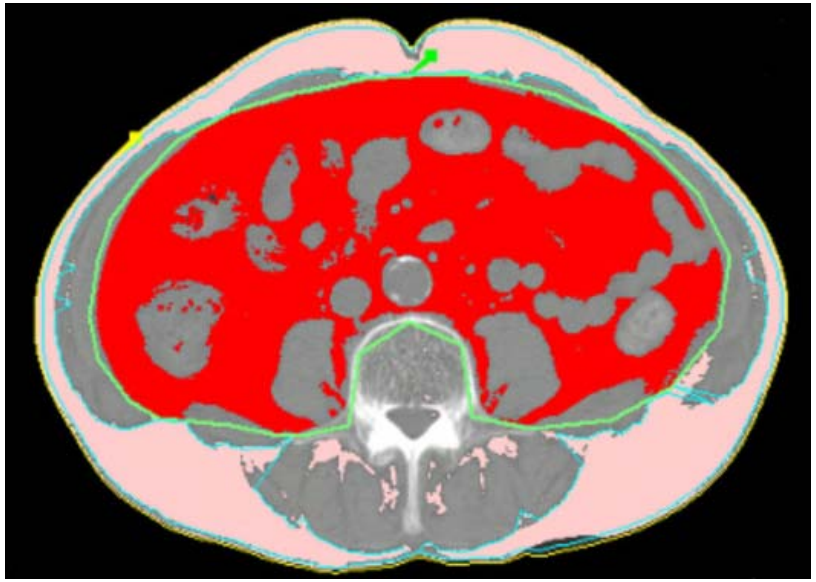
Eckel RH, et al. Circulation 2014; Supplement July 1, 2014

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.

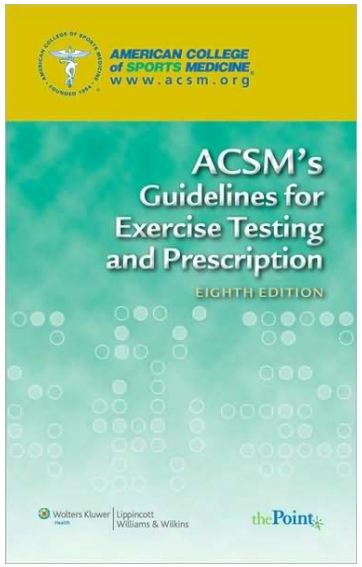
Krauss WE, et al. *N Engl J Med*. 2002;347:1483-1492.

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



Yates T, et al. *Diabetes Care* 2009;32:1404; Velthuis MJ, et al. *Menopause* 2009;16:777; van der Heijden, et al. *J Clin Endo Met*. 2009;94:4292; Carey AL, et al. Exercise Mimetics, *Diabetologia*, 9/09; Hansen D. *Diabetologia* 2009; 52:1789–1797; Brown R. *Med Sci Sports Ex* 2009;41:497; Ribeiro ICD *Med Sci Spts Ex* 2008;40:779; Despres JP SYNERGIE Trial EAS 2008; Misra A, et al. *Diabetes Care* 2008;31:1282-1287; Bell LM, et al. *J Clin Endo Met* 2007;92:4230; Ekelund U, et al. *Diabetes Care* 2007;30:2101; Dekker M. *Metabolism* 2007;56:332; DiPietro L, et al. *JAP* 2006; Lee SJ & Ross *JAP* 2005;99:1220; Wong SL, et al. *Med Sci Sports Ex* 2004;36:286; Duncan GE *Diabetes Care* 2003;26:557; Ross R, et al. *Obes Res. 2004;*12:789-798; Ross R, et al. *Relat Met Dis* 2003;27:204; Mourier A ,et al. *Diabetes Care* 1997;20:385; Ross R, et al. *Ann Intern Med* 2000;133:92.

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.

ACSM, Guidelines for Exercise Testing and Prescription, 8th Ed, Lippincott Williams & Wilkins, 2009.

2013 ACC/AHA Summary Recommendations for Exercise

- 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

NLA Lifestyle Therapies: Exercise/Physical Activity

- The recommended minimal quantity of exercise for supporting cardiovascular health and improving the lipid profile (lowering TG and sometimes raising HDL-C) is **150 min per week of moderate to higher intensity aerobic activity**. This level of physical activity is consistent with public health recommendations.

- **To enhance the effects on TG and HDL-C, and produce reductions in LDL-C, as well as loss of body fat and weight, ≥2000 kcal per week of energy expenditure (generally 200 to 300 min per week)** of moderate or higher intensity physical activity is recommended.

- Resistance exercise is also recommended to play a supportive role in maintaining strength, balance, and bone density.

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]

1. Swinburn BA, et al. *Am J Public Health*. 1998;88:288-291.
2. Wee CC. *JAMA*. 2001;286:717-719.

FIT = Frequency Intensity Time

Part 4

Practical Approach to Weight Loss

Potential Factors Contributing to Obesity

Evolutionary

- Early ancestors had to adapt to caloric scarcity
- Women with a more active metabolism lost fat reserves in times of caloric scarcity and were unable to procreate

Current Environmental Factors

- Network phenomenon
- Marketing of high caloric density food items
- Cycle of stress, eating and reward
- Low cost of high caloric density compared to low caloric density foods
- Possible epigenetic phenomenon or endocrine disrupters

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

NHLBI. Expert Panel. Clinical Guidelines on the Identification, Evaluation and Treatment of Overweight and Obesity in Adults: Evidence Report (NIH Pub No. 98-4083);1998.

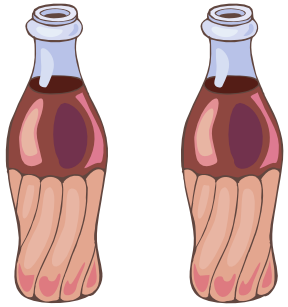
Exercise or Caloric Restriction for Weight Loss?: Achieving 300 kcal Negative Energy Balance

Reduce intake by:

Eliminating 2 oz potato chips

or

Substituting 2 diet sodas for 2 regular sodas



Or increase activity by:

Running 3 miles in 30 min

or

Bicycling 8 miles in 30 min

Common Weight Loss Diets

- Low Carb, High Protein, High Fat Diets
- Low Fat, High Carb
- 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

Shai I, et al. *N Engl J Med*. 2008;359:229-241.

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

Sacks FM, et al. *N Eng J Med*. 2009;360:2247-2248.

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)

Sacks FM, et al. *N Engl J Med*. 2009 26;360:859-873

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
  - **Atkins** (very low in carbohydrate, high protein)
  - **Zone** (low in carbohydrate)
  - **LEARN** (Lifestyle, Exercise, Attitudes, Relationships, and Nutrition; low in fat, high in carbohydrate), and
  - **Ornish** (very high in carbohydrate, very low fat)

Gardner CD, et al. *JAMA*. 2007;297(9):969-977

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

Gardner CD, et al. *JAMA*. 2007;297(9):969-977

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

www.nwcr.ws/Research/default.htm Accessed 04/11/2010

Address the Obesity Epidemic via Small Changes Approach*

- Small changes are more feasible to achieve and maintain than large changes
  - 2000 more steps/day (expends extra 100 kcal)
  - Simple food substitutions (Replace regular 12-oz soda with diet soda, ↓ caloric intake 150 kcal)
- Small changes can impact body weight regulation
  - Slight energy discrepancy (higher intake + lower output) has created an "energy gap" → weight gain
  - Average energy gap in adults is ~ 100-200 kcal/day

*Report of the Joint Task Force of the American Society for Nutrition, Institute of Food Technologists, and International Food Information Council; Endorsed by the American Dietetics Association, the American Heart Association and the American Cancer Society

Resources: www.smallstep.gov www.surgeongeneral.gov/priorities/prevention/

Hill JO. *Am J Clin Nutr*. 2009;89:477-484.

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 Obesity

- Very low calorie diets (800-1000 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
  - Liraglutide, locaserin, bupropion/naltrexone, phentermine/topiramate, phentermine, and orlistat all approved for weight loss
  - Each can be associated with significant tolerability issues and risk of adverse events
- Bariatric Surgery
  - Indicated for BMI ≥ 40 kg/m2 or ≥35 kg/m2 in setting of significant co-morbidities
  - RNY and gastric sleeve are most commonly performed

Part 5

The Effect of Nutritional Supplements on Lipids

Alcohol and CHD

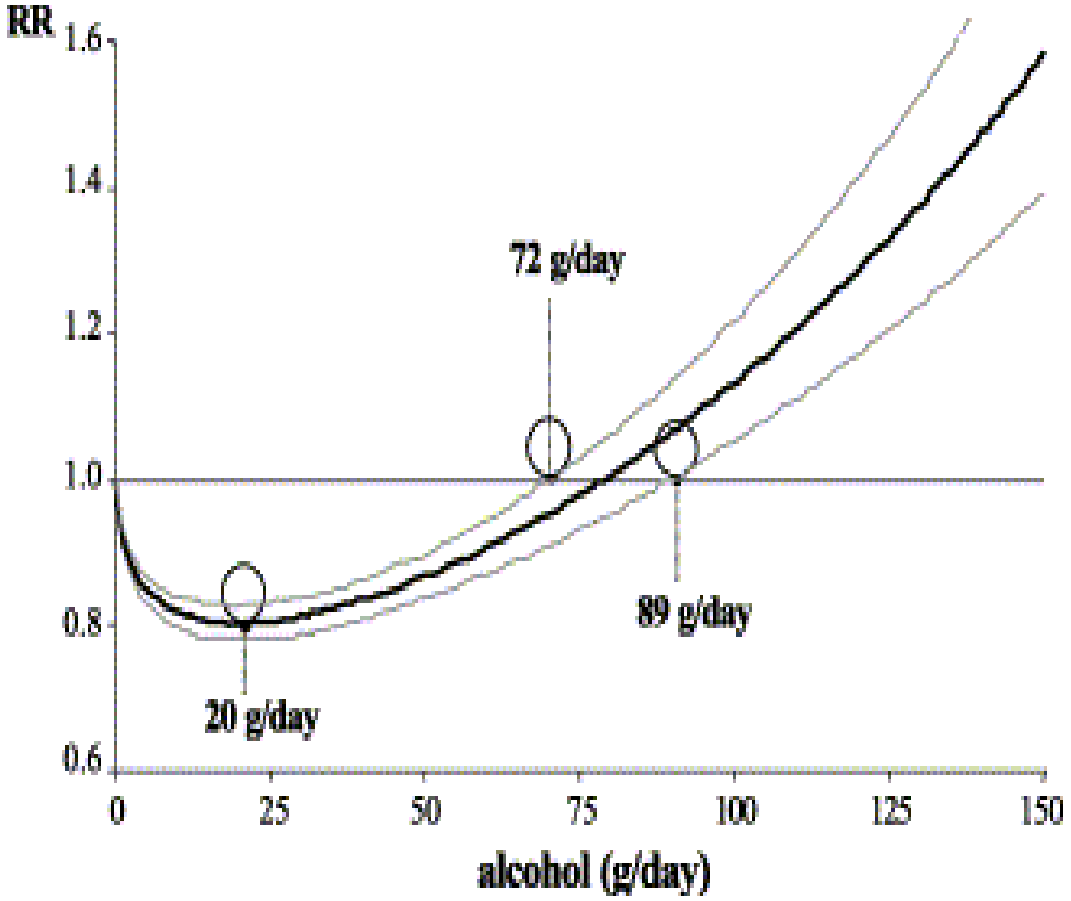
- There is a "U-shaped" curve
  - One drink lowers CHD risk vs. risk in teetotalers
  - Increasing amounts lead to increasing total mortality
- No difference between red and white wine in ecological, epidemiological studies
  - Resveratrol in red wine may have CV benefits via ↓ LDL oxidation, ↑ nitric acid, or by changes in thrombogenicity, ischemia, or vascular tone[1]
- Observational data

  Alcohol intake may be causally related to lower risk of CHD through changes in lipids (HDL-C, Apo AI, TG) and hemostatic factors[2]

1. Opie LH, et al. *Eur Heart J.* 2007;28:1683-1693.
2. Rimm EB, et al. *BMJ*. 1999;319:1523-1528.

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

Corrao G, et al. *Prev Med*. 2004;38:613-619.

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 malabsoprtion[3,4]

1. Katan MB, et al. *Mayo Clinic Proc*. 2003;78:965-978.
2. Demonty I, et al. *J Nutr*. 2009;139:271-284.
3. Miettinen TA, Gylling H. *Curr Opin Lipidol*. 1999;10:9-14.
4. Gylling H, et al. *J Lipid Res*. 1999;40:593-600.

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

Katan MB, et al. *Mayo Clin Proc*. 2003;78:965-978.

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 → ↓1.7 mg/dL in LDL-C[2]
- Adding 5-10 g/d of viscous fiber to the diet would be expected to → ↓ LDL-C by ~6.5-13%

Apo B = apolipoprotein B

1. FDA. 2008.
2. Brown L, et al. *Am J Clin Nutr.* 1999;69:30-42.

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

Jenkins DJ, et al. *JAMA*. 2003;290:502-510.

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)

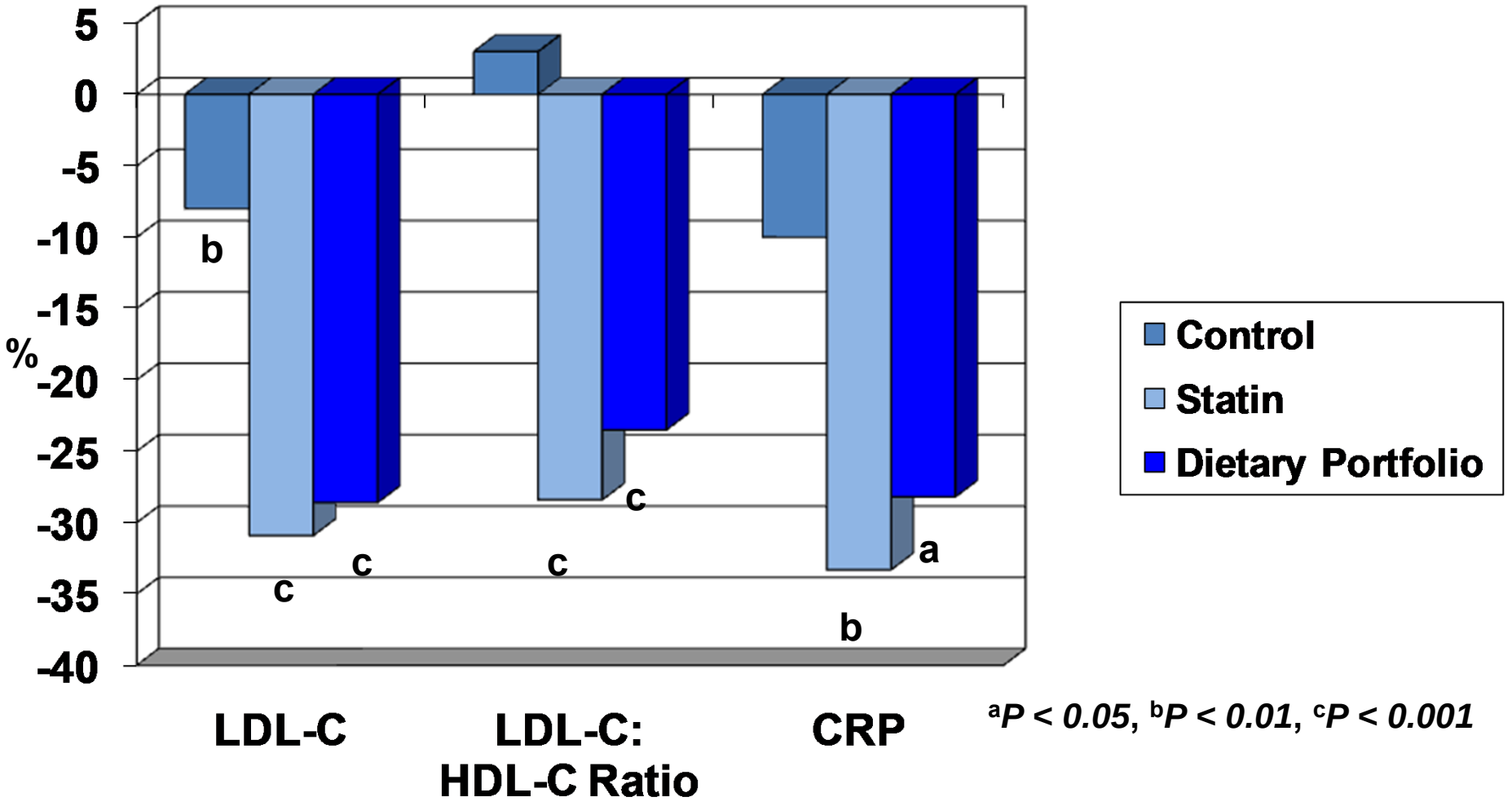
Jenkins DJ, et al. *JAMA*. 2003;290:502-510.

Rationale for Portfolio of Choices

Dietary Choices	Mechanism	Lowering of LDL-C
Viscous Fibers	Increase bile acid losses	6-7% for 10 g of pysllium
Soy Proteins	Reduce hepatic cholesterol synthesis, increase LDL receptor messenger RNA	12.5% for 45 g of soy proteins
Plant Sterols	Reduce cholesterol absorption	13% for 1-2 g of plant sterols
Almonds (MUFA and plant-sterol-rich oil)	Shown to lower LDL-C	1% for 10 g of almonds

Adapted from Jenkins DJ, et al. *JAMA*. 2003;290:502-510.

Results of Portfolio Diet: Lipids and CRP



$^{a}P < 0.05$, $^{b}P < 0.01$, $^{c}P < 0.001$

Jenkins DJ, et al. *JAMA*. 2003;290:502-510.

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**
  - Nutrition Facts - http://www.americanheart.org/presenter.jhtml?identifier=855
  - 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**
  - 10-year Risk Calculator - http://hp2010.nhlbihin.net/atpiii/calculator.asp?usertype=pub
  - Your Guide to a Healthy Heart - http://www.nhlbi.nih.gov/health/public/heart/other/your_guide/healthyheart.htm
- **AND**
  - Find a Registered Dietitian - http://www.eatright.org/cps/rde/xchg/ada/hs.xsl/index.html
- **USDA/HHS**
  - MyPyramid.Gov - http://www.mypyramid.gov/

AND = Academy of Nutrition and Dietetics; HHS = Health and Human Services