

Diet and Cardiovascular Risk

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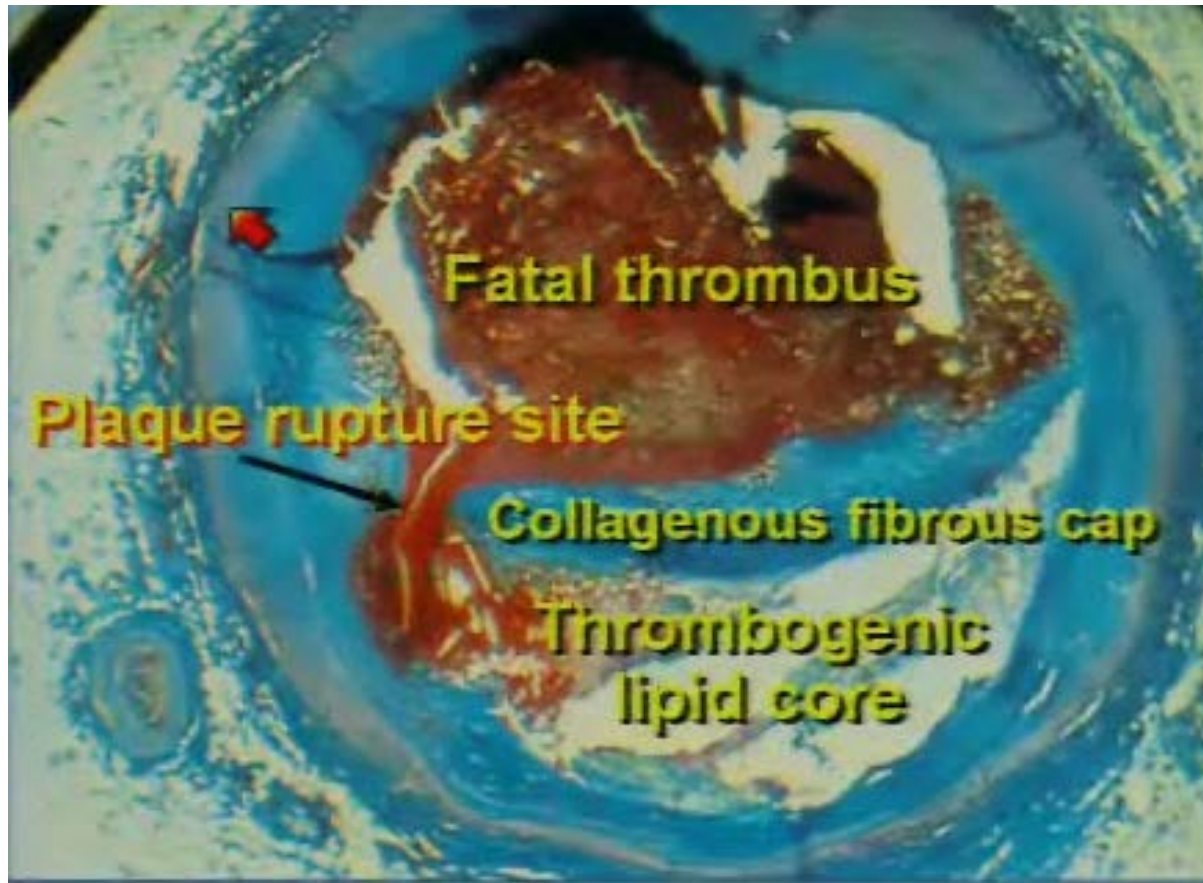
March 24, 2015

Poor Diet and Decreased Physical Activity:

very important causes of preventable death
Most preventable causes of death in the U.S. in 1990 and 2000

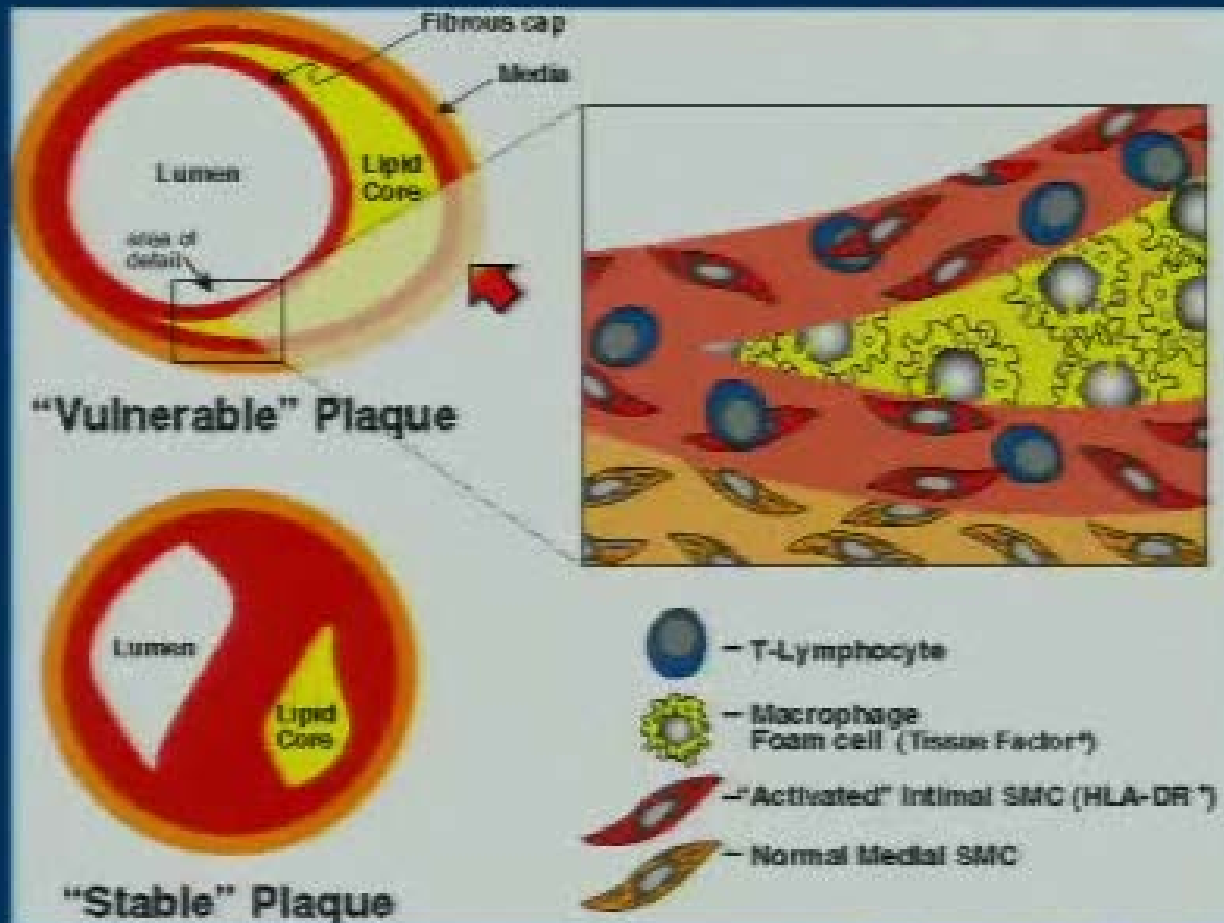
Causes	# (%) in 1990	# (%) in 2000
Tobacco	400,000 (19)	435,000 (18)
Poor diet and physical activity (obesity)	300,000 (14)	400,000 (17)
Alcohol consumption	100,000 (5)	85,000 (4)
Microbial agents	90,000 (4)	75,000 (3)
Toxic agents	60,000 (3)	55,000 (2)
Motor vehicle accidents	25,000 (1)	43,000 (2)
Firearms	35,000 (2)	29,000 (1)
Sexual behavior	30,000 (1)	20,000 (<1)
Illicit drug use	20,000 (<1)	17,000 (<1)
Total	1,060,000 (50*)	1,159,000 (48%*)

What are we trying to stop?

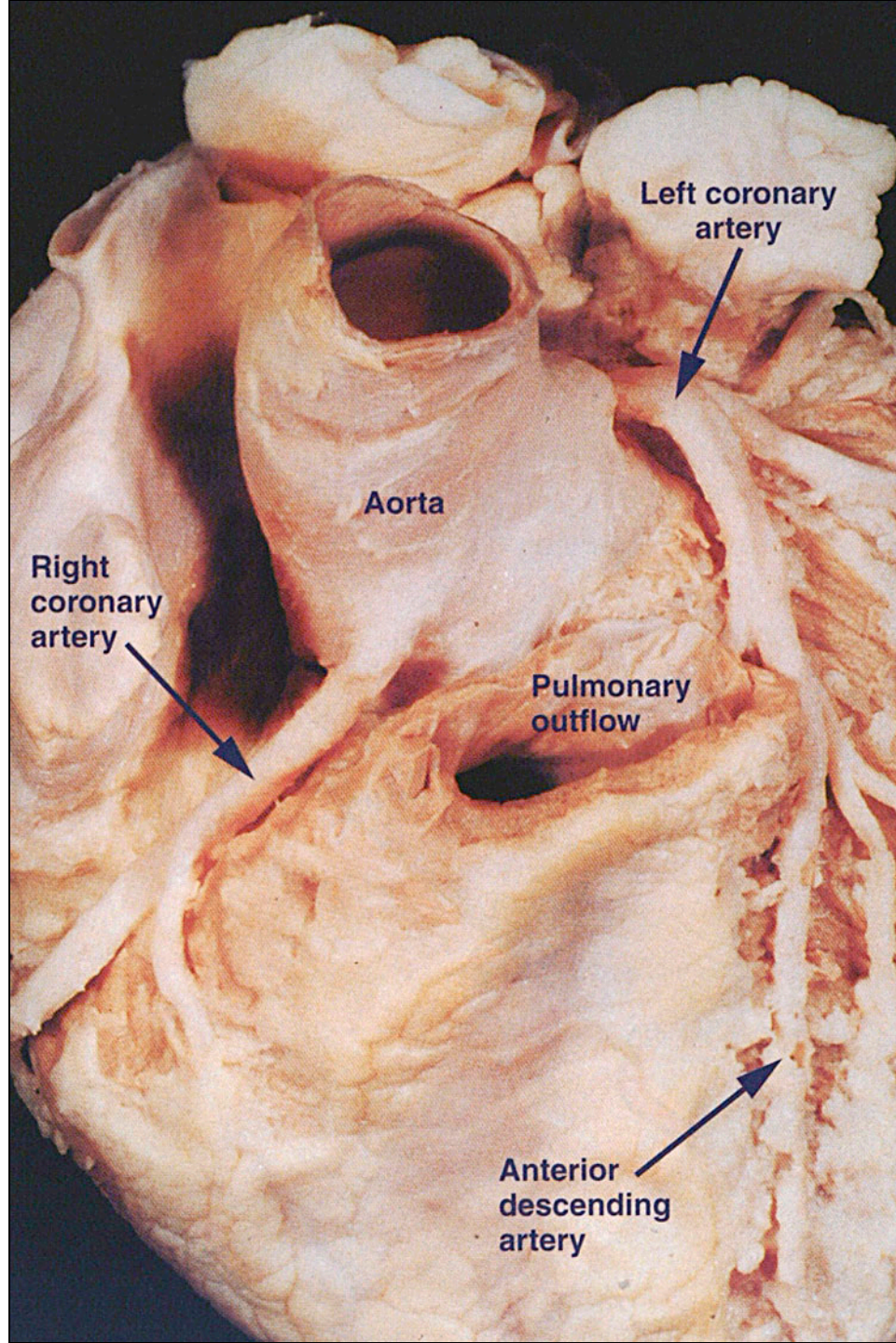




The Stable vs. Vulnerable Plaque



Libby P. Circulation 1995



Left coronary artery

Aorta

Right coronary artery

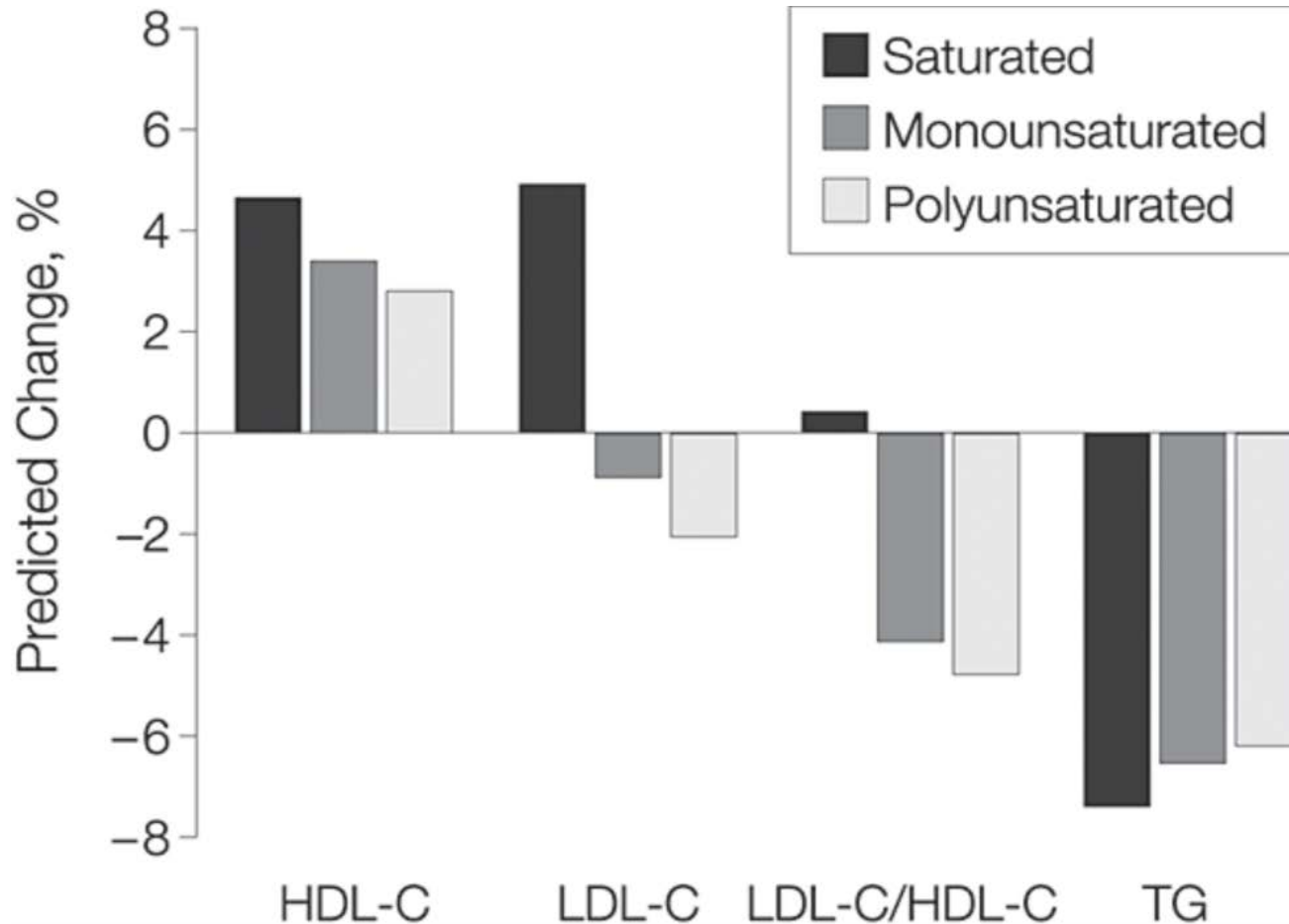
Pulmonary outflow

Anterior descending artery

Diet and Atherosclerosis

- Atherosclerotic disease is the leading cause of death in industrialized countries .
- In 1908, Ignatowski produced atherosclerosis in rabbits with a diet high in cholesterol and saturated fat.
- Saturated fatty acids increase and polyunsaturated fatty acids decrease total and LDL cholesterol.

Replacement of 5% of energy from carbohydrates with specific fatty acids under isocaloric conditions.

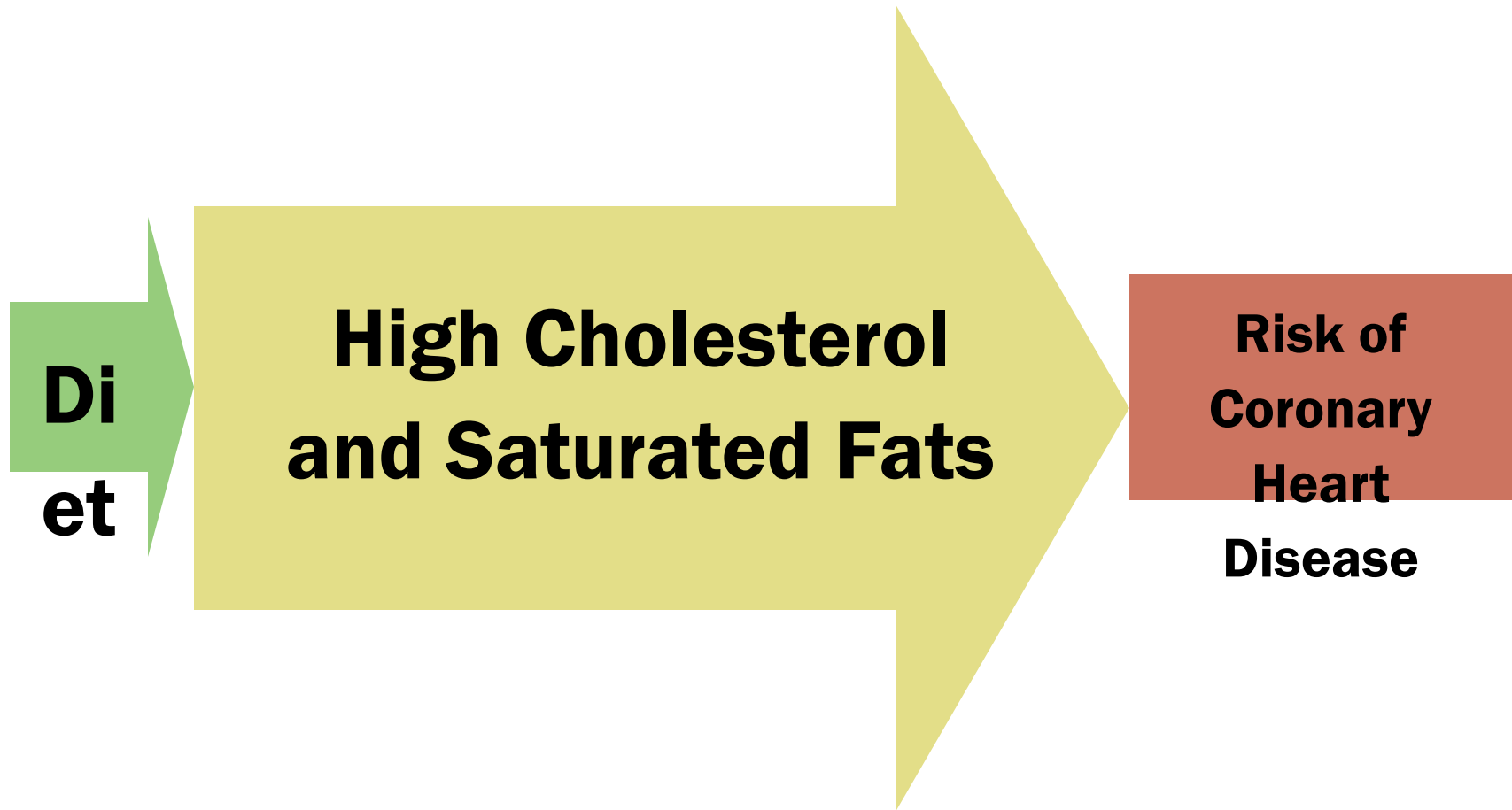


Diet and Atherosclerosis

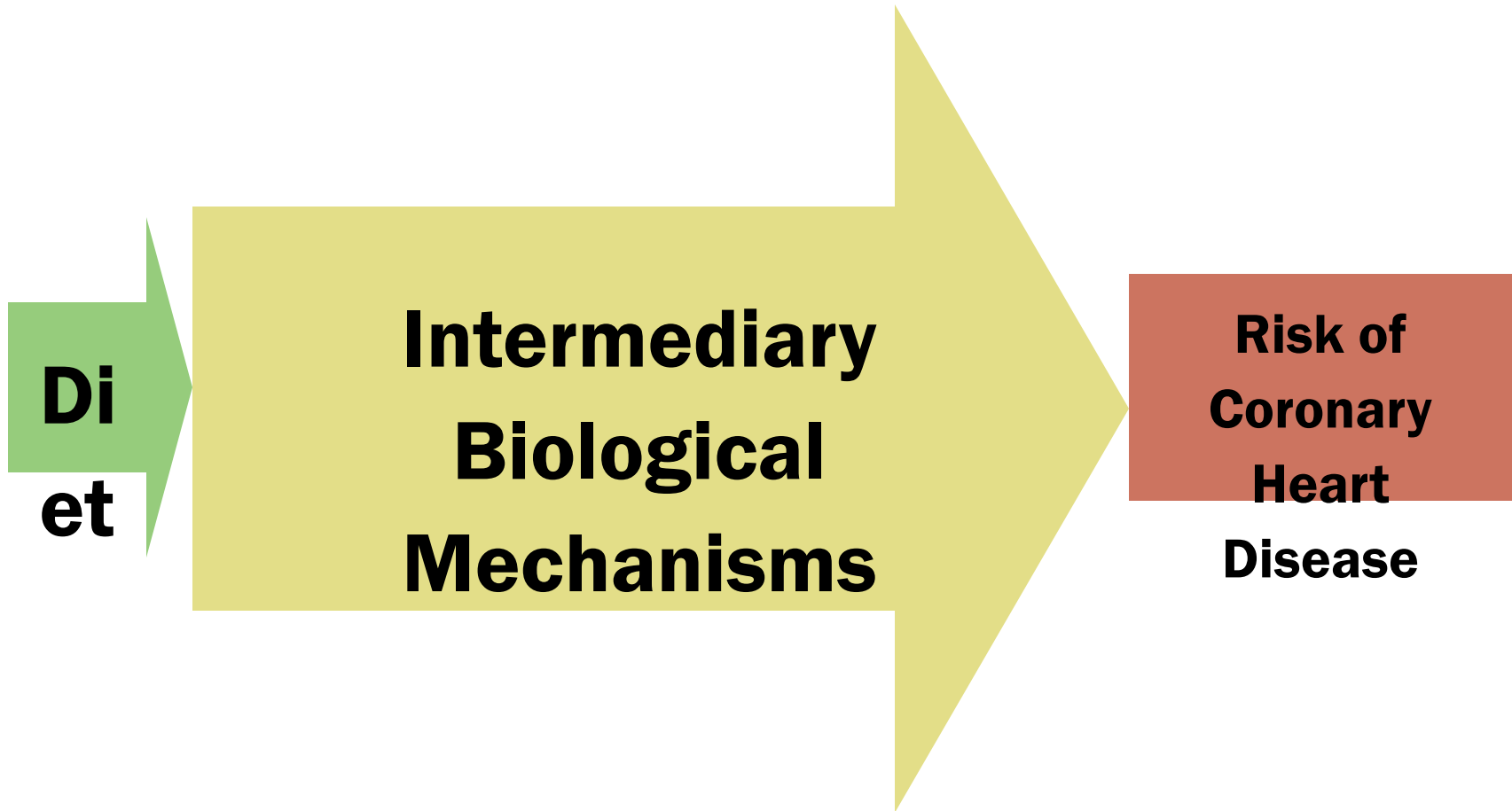
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The Heart-Diet Hypothesis

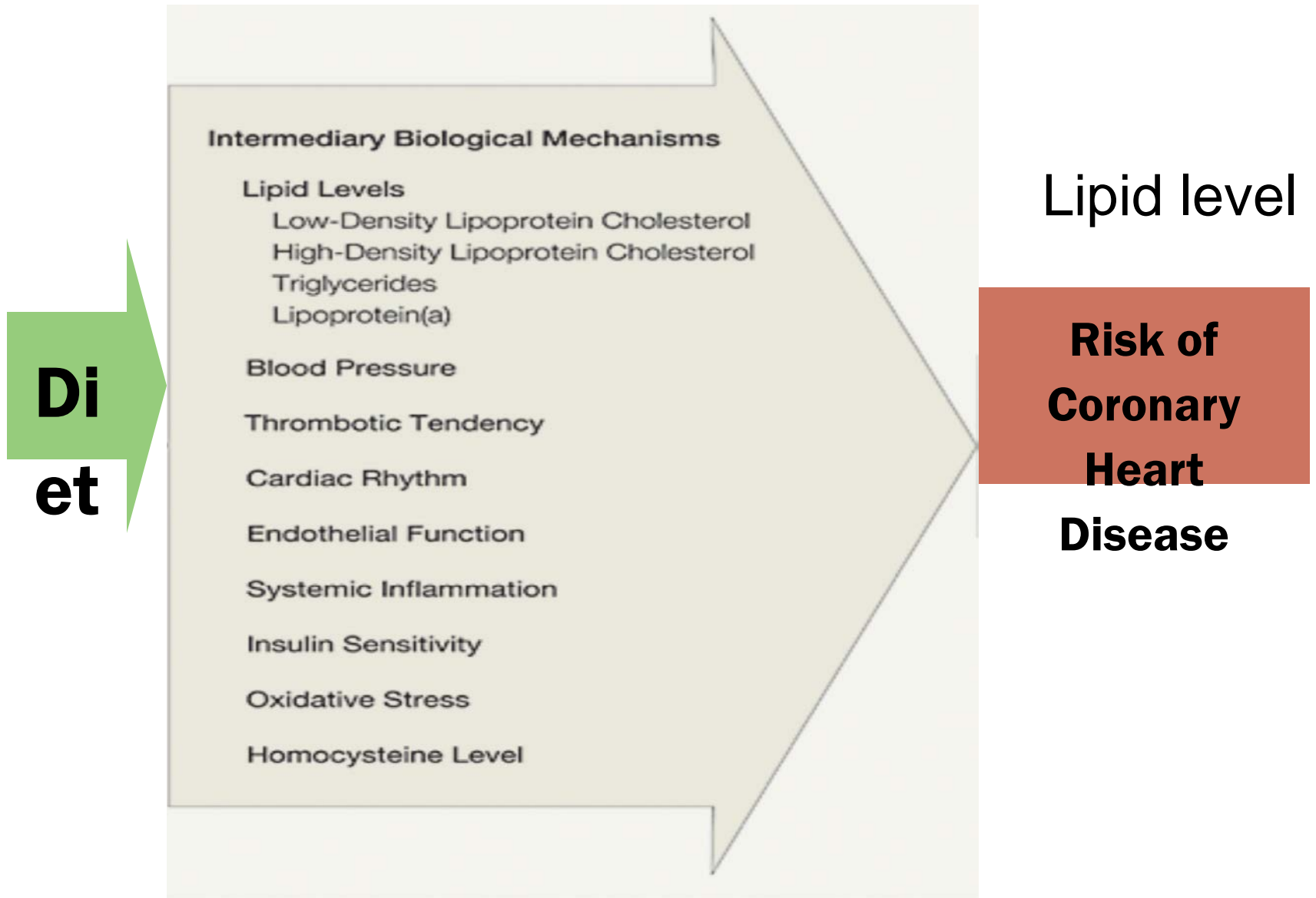
The Heart-Diet Hypothesis



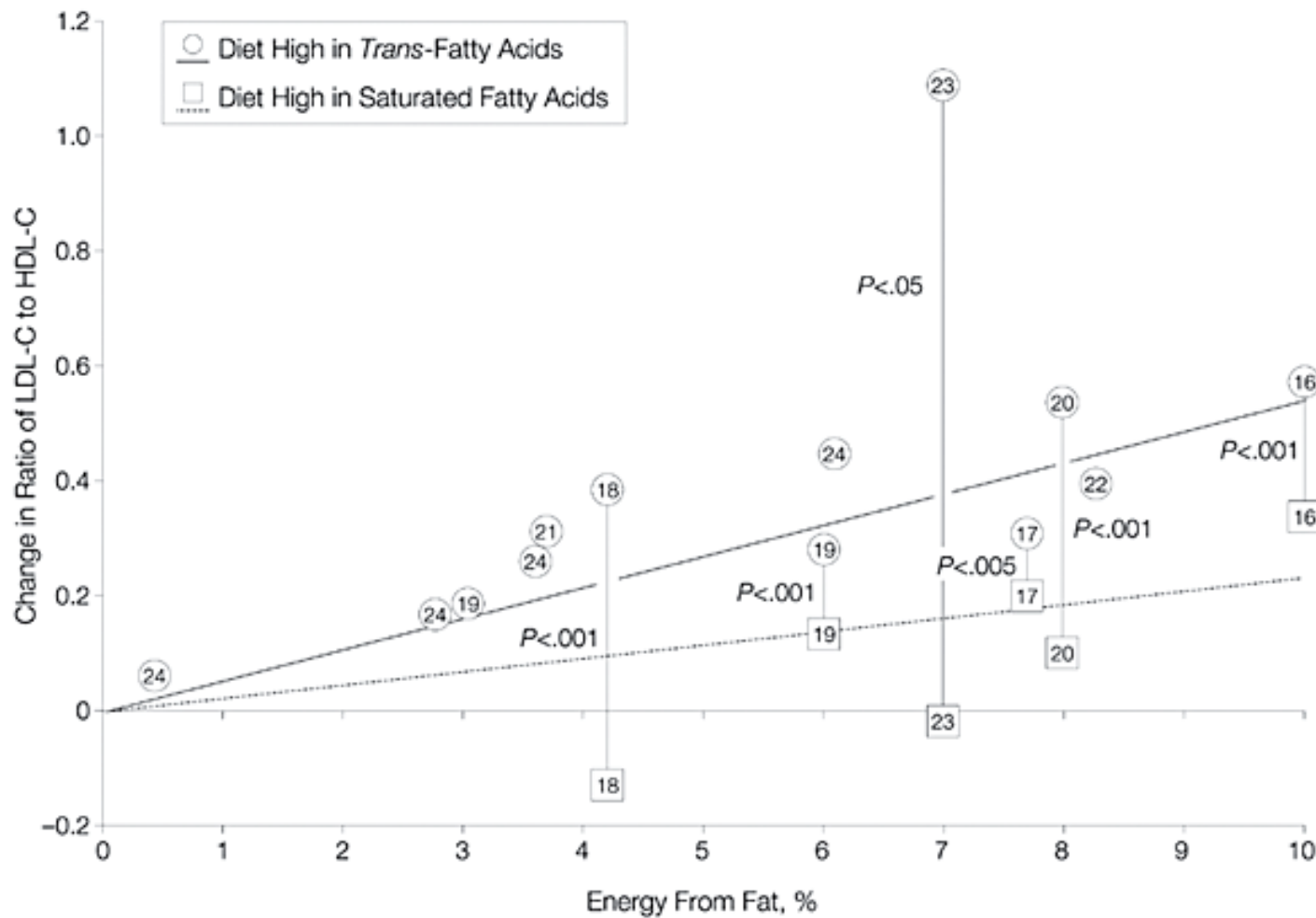
Relationship Between Diet and CV Disease



Relationship Between Diet and CV Disease



Trans-fatty acids increase LDL and lower HDL relative to cis-unsaturated fatty acids.



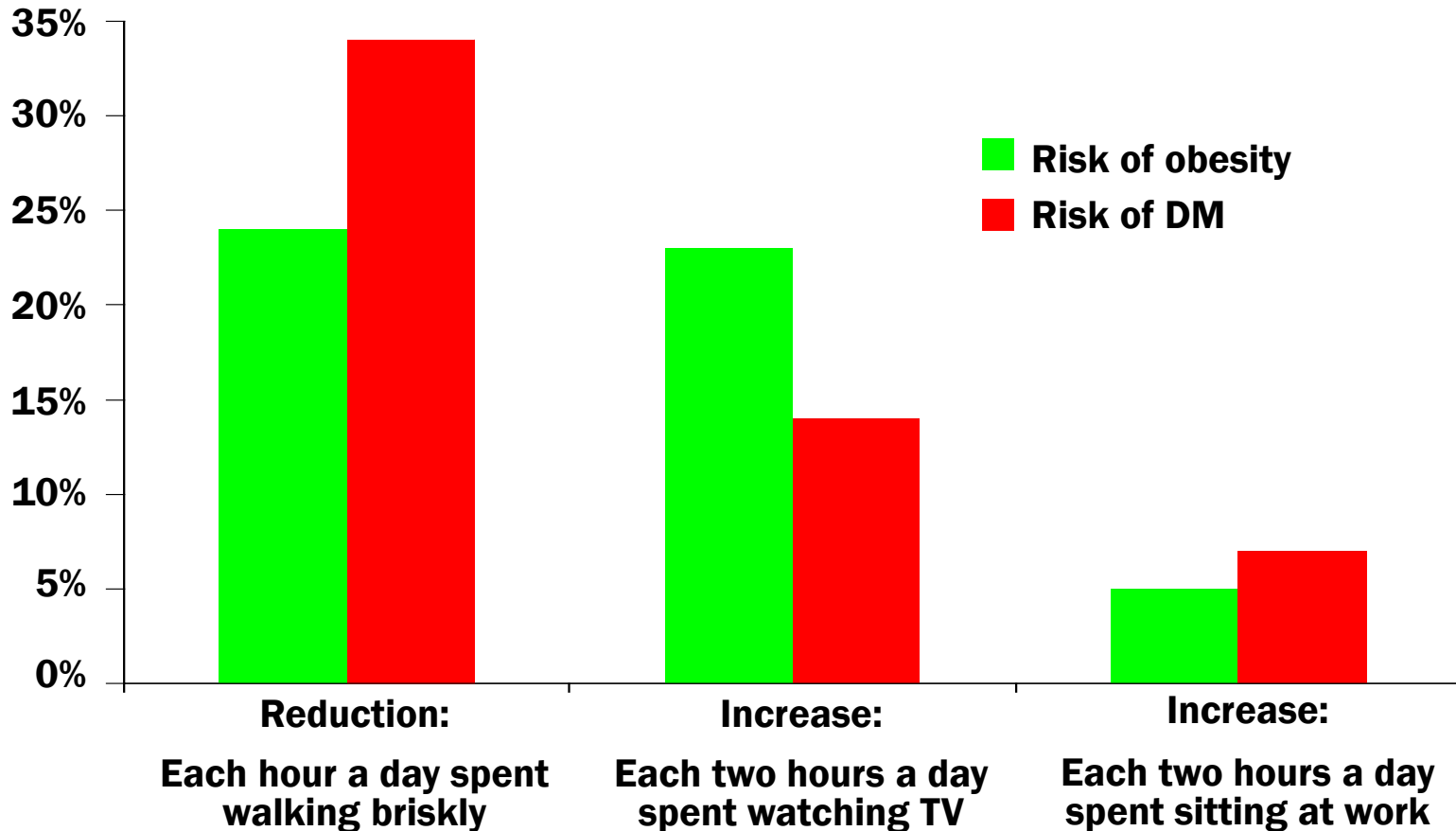
Ascherio A, et al. *N Engl J Med.*1999;340:1994-1998.

Trans-fatty acids

- Found in stick margarine, vegetable shortenings, commercial bakery and deep-fried foods.
- May reduce endothelial function, promote insulin resistance and increase risk of type 2 diabetes.
- Increases plasma levels of lp a.
- In the Nurses' Health Study (80,082 nurses):
The higher intakes of *trans*-fat and, to a smaller extent, saturated fat were associated with increased risk, whereas higher intakes of polyunsaturated and monounsaturated fats were associated with decreased risk of cardiovascular events.

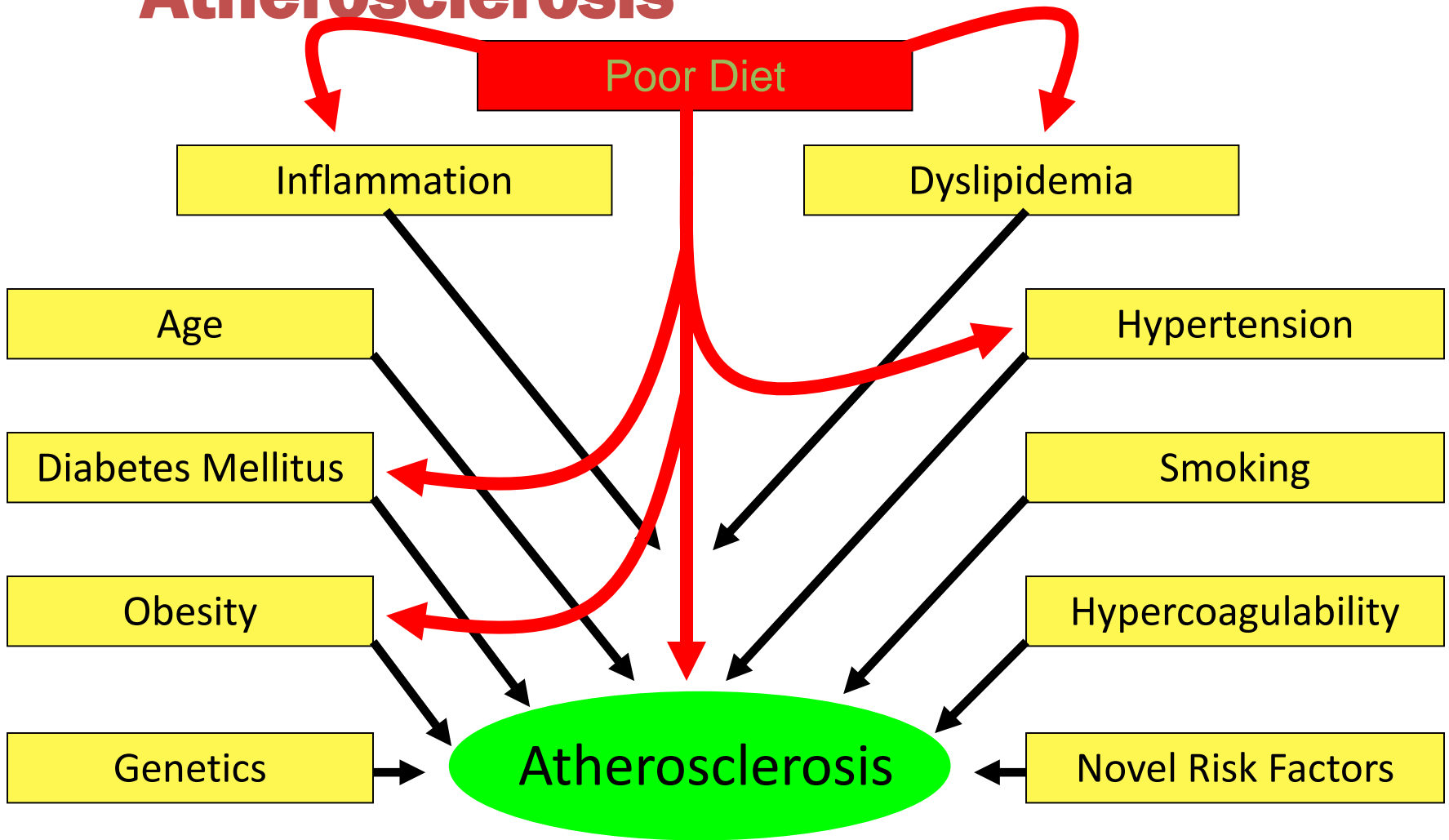
Exercise Evidence: Effect on Obesity and Diabetes Mellitus (DM)

Nurses' Health Study



Exercise reduces the incidence of obesity and DM

Some Factors Affecting Atherosclerosis



Therapeutic Lifestyle Changes (TLC) Diet endorsed by NCEP and AHA.

Nutrient	Recommended Intake
Saturated Fat*	<7% of Total Calories
Polyunsaturated Fat	Up to 10% of Total Calories
Monounsaturated Fat	Up to 20% of Total Calories
Total Fat	25%-35% of Total Calories
Carbohydrate**	50%-60% of Total calories
Fiber	20-30 Grams/Day
Protein	Approximately 15% of total Calories
Cholesterol	<200 mg/Day
Total Calories (Energy)	Balance Energy Intake and Output to Maintain Expenditure Healthy Body Weight/Prevent Weight Gain

Omega-3
Fatty Acids



* Lower Trans Fatty Acids



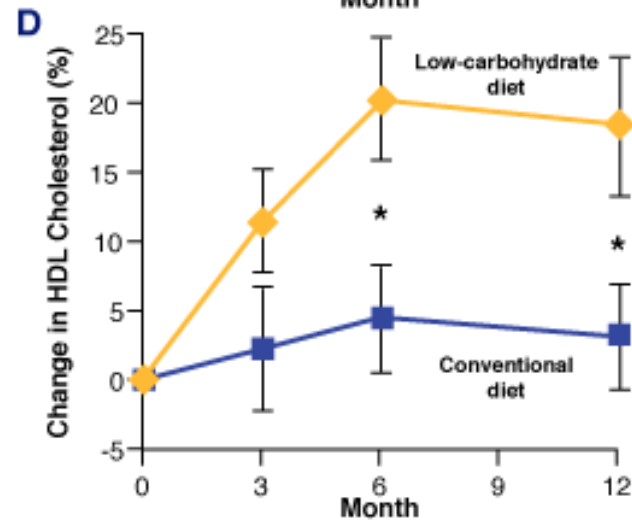
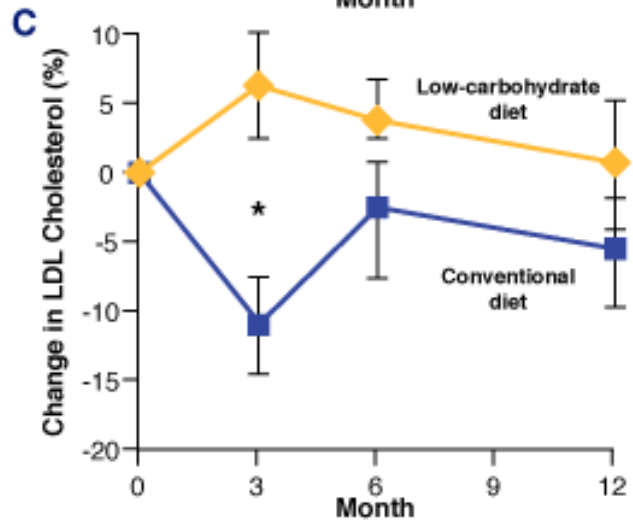
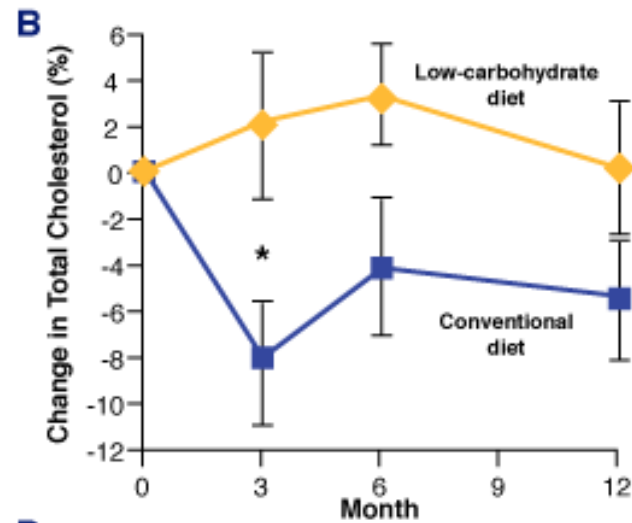
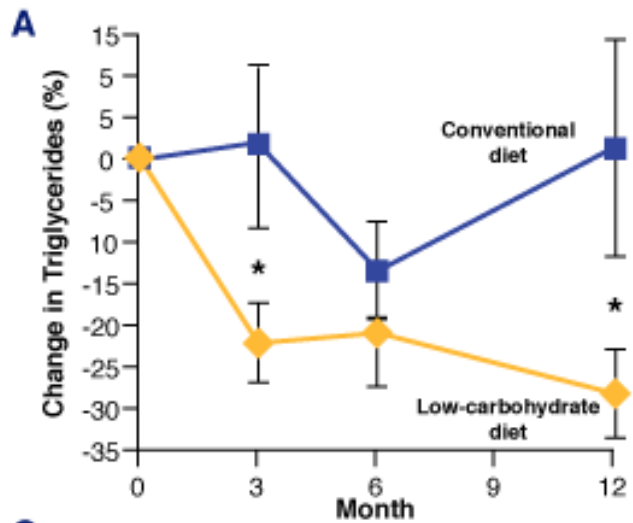
**Emphasize Complex Sources

Omega-3 Fatty Acids







American Heart Association Diet and Lifestyle Recommendation Revision 2006

- Consume fish at least twice a week.
- Especially oily fish rich in very long-chain omega-3 polyunsaturated fatty acids.
- The consumption of two servings (~8 ounces) per week of fish is associated with reduced risk of sudden death and death from CAD in adults.
- Methods used to prepare fish should minimize the addition of saturated and trans fatty acids, as occurs with the use of cream sauces or hydrogenated fat during frying.

Low Carbohydrate Diet Effect on Cholesterol



Dash Diet

Food Group	Daily Servings	1 Serving Equals	Example and Notes
Grains and Grain Products 	7-8	1 Slice Bread 1/2 Cup Dry Cereal 1/2 Cup Cooked Rice, Pasta, or Cereal	Whole-Wheat Breads, English Muffin, Pita Bread, Bagel, Cereal and Fiber, Grits, Oatmeal; Provide Energy and Fiber.
Vegetables 	4-5	1 Cup Raw Leafy Vegetables 1/2 Cup Cooked Vegetable 6 oz Vegetable Juice	Tomatoes, Potatoes, Carrots, Peas, Squash, Broccoli, Turnip Greens, Collards, Kale, Spinach, Artichokes, Beans, Sweet Potatoes; Source of Potassium, Magnesium, and Fiber.
Fruits 	4-5	8 oz Fruit Juice 1 Medium Fruit 1/4 Cup Dried Fruit 1/2 Cup Fresh, Frozen or Canned Fruit	Apricots, Bananas, Dates, Grapes, Oranges, Orange Juice, Mangoes, Melons, Peaches, Pineapples, Prunes, Raisins, Strawberries, Tangerine; Provide Potassium, Magnesium, and Fiber.
Low-Fat and Nonfat Dairy 	2-3	8 oz Milk 1 Cup Yogurt 1 1/2 oz Cheese	Skim or 1% Milk, Skim or Low-Fat, Buttermilk, Nonfat or Low-Fat Yogurt, Part Skim Mozzarella Cheese, Nonfat Cheese; Major Source of Calcium and Protein.
Meat, Poultry, Fish 	2 or Fewer	3 oz Cooked Meats, Poultry, or Fish	Select Only Lean; Trim Away Visible Fats; Broil, Roast, or Boil, Instead of Frying; Remove Skin From Poultry. Rich Sources of Protein and Magnesium.
Nuts 	1/2	1 1/2 oz or 1/3 Cup 2 tbs Seed 1/2 Cup Cooked Legumes	Almonds, Filberts, Mixed Nuts, Peanuts, Walnuts, Sunflower Seeds, Kidney Beans, Lentils; Provide Energy, Protein, and Fiber.

Dietary Treatment for Hypertension

Lifestyle Modifications³ (LM)

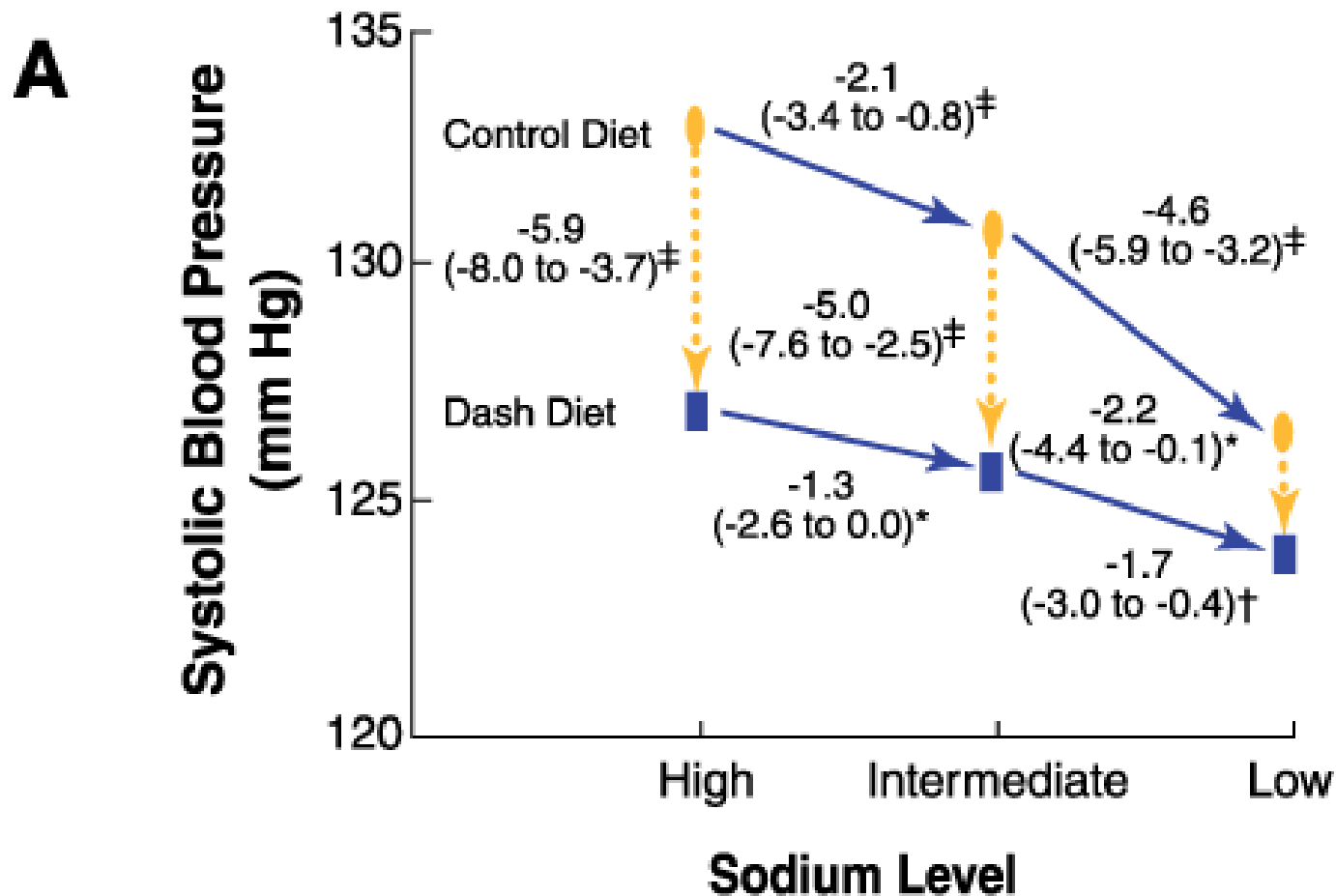
Modification	Recommendation	Approximate SBP Reduction (Range) ^{**}
Reduce weight	Maintain normal body weight (body mass index 18.5–24.9 kg/m ²)	5–20 mm Hg/10 kg
Adopt DASH ^{*§} eating plan	Consume a diet rich in fruits, vegetables, and low-fat dairy products with a reduced content of saturated and total fat	8–14 mm Hg
Lower sodium intake [§]	a. Consume no more than 2,400 mg of sodium/day; b. Further reduction of sodium intake to 1,500 mg/day is desirable since it is associated with even greater reduction in BP; and c. Reduce intake by at least 1,000 mg/day since that will lower BP, even if the desired daily sodium intake is not achieved	2–8 mm Hg
Physical activity	Engage in regular aerobic physical activity such as brisk walking (at least 30 min per day, most days of the week)	4–9 mm Hg
Moderation of alcohol consumption	Limit consumption to no more than 2 drinks (e.g., 24 oz beer, 10 oz wine, or 3 oz 80-proof whiskey) per day in most men, and to no more than 1 drink per day in women and lighter weight persons	2–4 mm Hg

* DASH, dietary approaches to stop hypertension

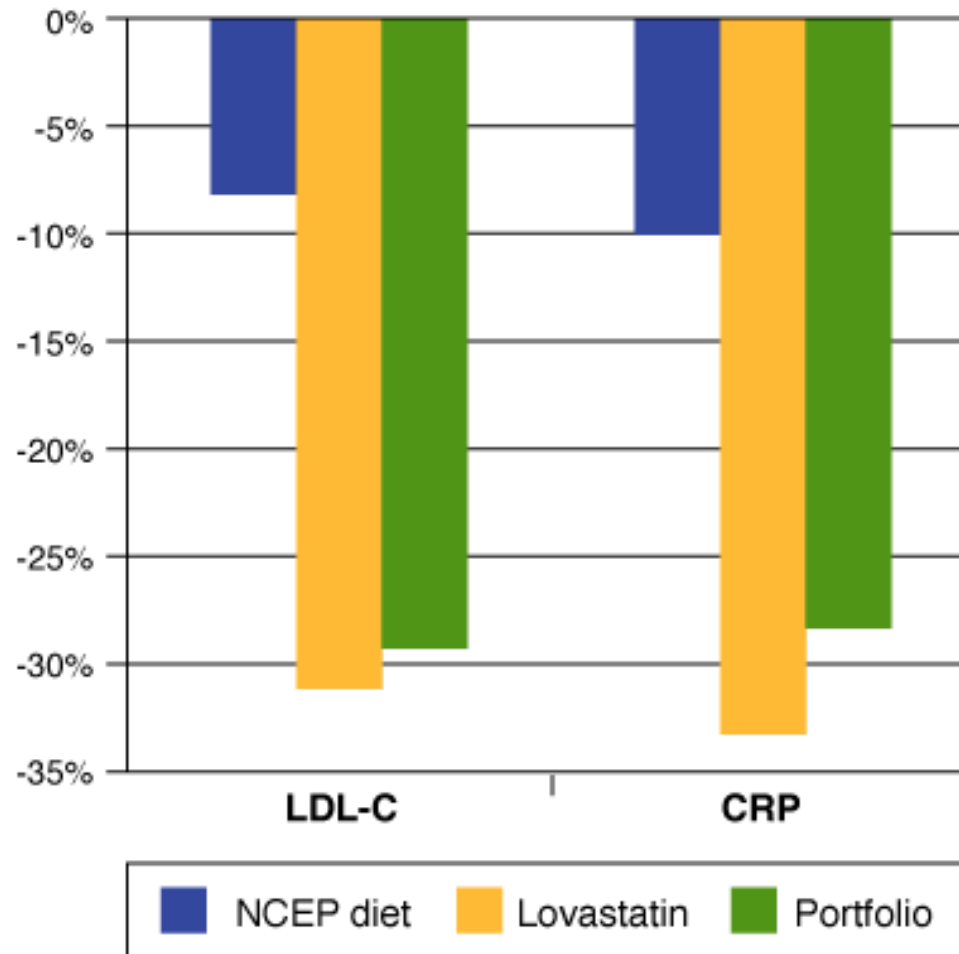
** The effects of implementing these modifications are dose and time dependent, and could be greater for some individuals

- *J Am Coll Cardiol.* 2014;63(12):1230-1238. doi:10.1016/j.jacc.2013.11.007

DASH Diet and Salt Restriction Effect on Hypertension



Portfolio Diet- (Diet Enriched with Almonds, Plant Sterols, Soy Products, Fiber) Effect on Cholesterol and CRP



Effects of Soy Protein Intake on Serum Lipids

- the consumption of soy protein rather than animal protein significantly decreased serum concentrations of total cholesterol, LDL cholesterol, and triglycerides.
- A meta-analysis of 38 trials of soy protein consumption in humans revealed an improvement in total cholesterol by 9% and LDL by 13%, as well as a decrease in triglyceride levels of 10%

What is the Mediterranean Diet?

Low in

- Saturated fats
- Meat
- Dairy products
- Saturated and trans fats
- Processed foods
- Eggs

Foundation of the Mediterranean Diet

- Monounsaturated fats (extra-virgin olive oil)
- Breads and cereals (whole grains)
- Omega-3 fatty acids (from fish, shell fish)
- Seasonally fresh fruits and vegetables
- Nuts
- Legumes
- Moderate wine intake (especially red wine)
- Physical activity

The Mediterranean Dietary Pattern Consists of:

- (a)** Daily consumption: non refined cereals and products (whole grain bread, pasta, brown rice, etc.), vegetables (2 – 3 servings/day), fruits (6 servings/day), olive oil (as the main added lipid) and dairy products (1 – 2 servings/day)
- (b)** Weekly consumption: fish (4–5 servings/week); poultry (3 – 4 servings/week); olives, nuts, and pulses (e.g., peas, lentils, chickpeas) (3 servings/week); potatoes, eggs, and sweets (3 – 4 servings/week)
- (c)** Monthly consumption: red meat and meat products (4 – 5 servings/month)
- (d)** Moderate consumption: wine (1 – 2 wine glasses/day) and high monounsaturated: saturated fat ratio (> 2).

Sample Food that Make Up the Mediterranean Diet

Greece

- Spanakopita
- Dolmades
- Moussaka
- Souvlaki
- Rice pilaf
- Gyros
- Greek salad
- Orzo salad

France

- Bouillabaisse
- Tapenade
- Pistou
- Aioli
- Ratatouille
- Nicoise salad

Middle East

- Lentil soup
- Falafel
- Hummus
- Tabbouleh
- Fattoush
- Baba ghannouj
- Spinach pie
- Couscous
- Figs, dates

Italy

- Pasta
- Polenta
- Risotto
- Bread soup
- Gelato

Turkey

- Dolmas
- Kebabs
- Rice pilaf
- Konafa
- Corbasi

Spain

- Pasta
- Polenta
- Risotto
- Bread soup
- Gelato

Summary of Randomized, Controlled Trials with the Mediterranean-Style Diets

Study	Patients Enrolled	Follow-Up Time	Control Diet	Experimental Diet	Results
DART	2,033 Post-MI men	2 yrs	No dietary advice	Fatty fish twice per week with goal of 500–800 mg/day of N-3 fatty acids	29% reduction in all-cause mortality, 27% decrease in fatal MI
Indian Experiment of Infarct Survival	360 Post-acute MI	1 yr	Placebo	EPA supplement or ALA supplement	EPA: 50% decrease in cardiac death, 48% decrease in nonfatal MI ALA: 40% decrease in cardiac events
Lyon Diet Heart	605 Post-MI	46 months	Prudent Western-style diet	Mediterranean diet rich in fish, fruits, vegetables, and ALA margarine	68% decrease in cardiac death and nonfatal MI; protective effects lasted >4 years
Indo-Mediterranean Diet	1,000	2 yrs	Step I NCEP	Mediterranean style (fruits, grains, vegetables, mustard seed or soy bean oil, and walnuts)	Significant reduction in sudden cardiac death and nonfatal MI
GISSI-Prevenzione	11,324 Post-MI	3.5 yrs	Placebo	1 g/day omega-3 fatty acid fish-oil supplements	20% decrease in mortality, 30% decrease in CV deaths, 46% decrease in sudden deaths

* This table summarizes five randomized, controlled trials investigating the Mediterranean-style diet. The table lists the number of patients randomized, the length of follow-up, the control diet in study, the experimental diet, and the results of the study.

ALA = alpha-linolenic acid; CV = cardiovascular; EPA = eicosapentaenoic acid; MI = myocardial infarction; NCEP = National Cholesterol Education Program.

Lyon Heart Study

Components

- High intake of alpha-linolenic acid (precursor of n-3 long chain fatty acids)
- Rich in vegetables and fruits (natural antioxidants)

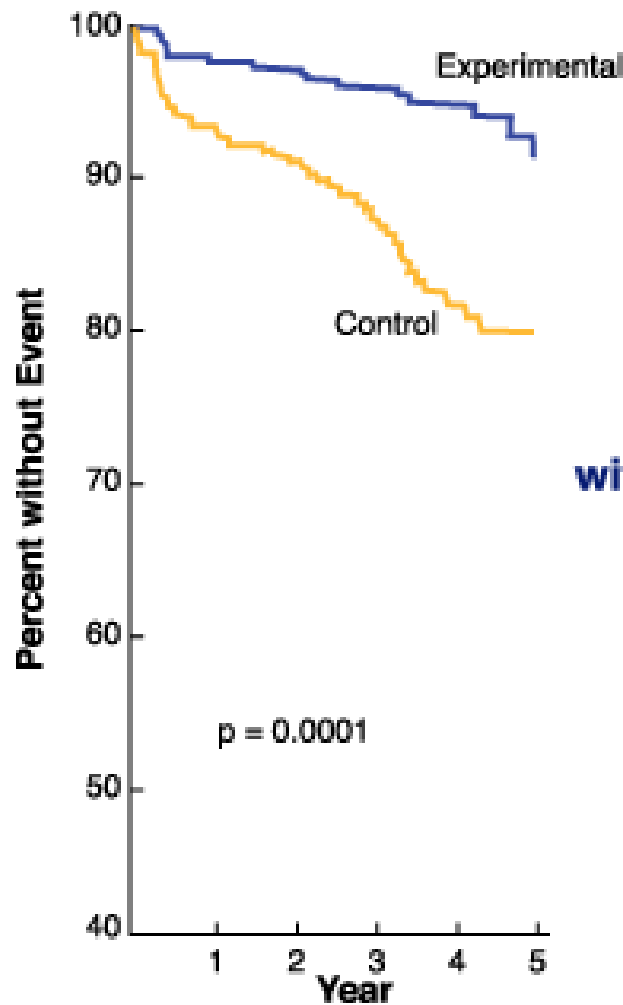
Dietary advice

- Bread and wine
- Root vegetables and green vegetables
- Fish and poultry instead of beef, lamb or pork
- No day without fruit
- Butter and cream replaced by margarine rich in alpha-linolenic acid
- Olive oil and canola oil for cooking and salads

Lyon Heart Study: Number of Events

Composite Outcome	Mediterranean Diet (n = 302) (No. of Events)	Western Diet (n = 303) (No. of Events)	p
1: Cardiac Death + MI	14	44	0.0001
2: CO1 + Secondary Endpoints*	27	90	0.0001
3: CO2 + Hospitalization for Minor Events	95	180	0.0002

*Unstable Angina, Stroke, Heart Failure, Pulmonary or Peripheral Embolism
MI = Myocardial Infarction; CO = Composite Outcome



**Survival without Nonfatal
Myocardial Infarction Among Patients
with a Prior MI Assigned to a Mediterranean
(Experimental) or AHA Step 1 (Control)
Diet in the Lyon Diet Heart Study**

Prospective investigation involving 22,043 adults in Greece. Results of 2 out of 10-point scale indicating degree of adherence to the traditional Mediterranean diet

Variable	No. of Deaths/ No. of Participants	Hazard Ratio for Death (95% CI)		
		Crude	Age- and Sex- Adjusted	Fully Adjusted
Death from any cause	275 / 22,043	0.74 (0.65-0.86)	0.79 (0.69-0.91)	0.75 (0.64-0.87)
Death from coronary heart disease	54 / 22,043	0.68 (0.50-0.94)	0.74 (0.54-1.02)	0.67 (0.47-0.94)
Death from cancer	97 / 22,043	0.81 (0.64-1.03)	0.85 (0.67-1.08)	0.76 (0.59-0.98)

2 years follow-up of Mediterranean-Style Diet vs Control – Prudent Diet (CHO 55%, protein 15-20%, fat < 30%).

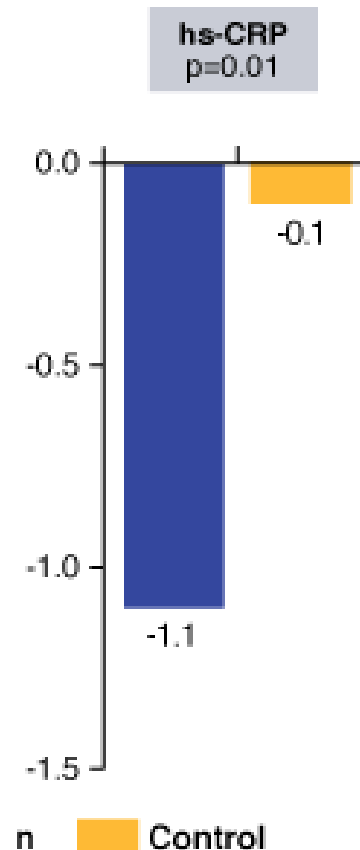
The Mediterranean Diet (vs Prudent Diet)

Weight reduction 4 kg (vs 1.2 Kg)

Metabolic syndrome in 34% of pts (vs 80%)

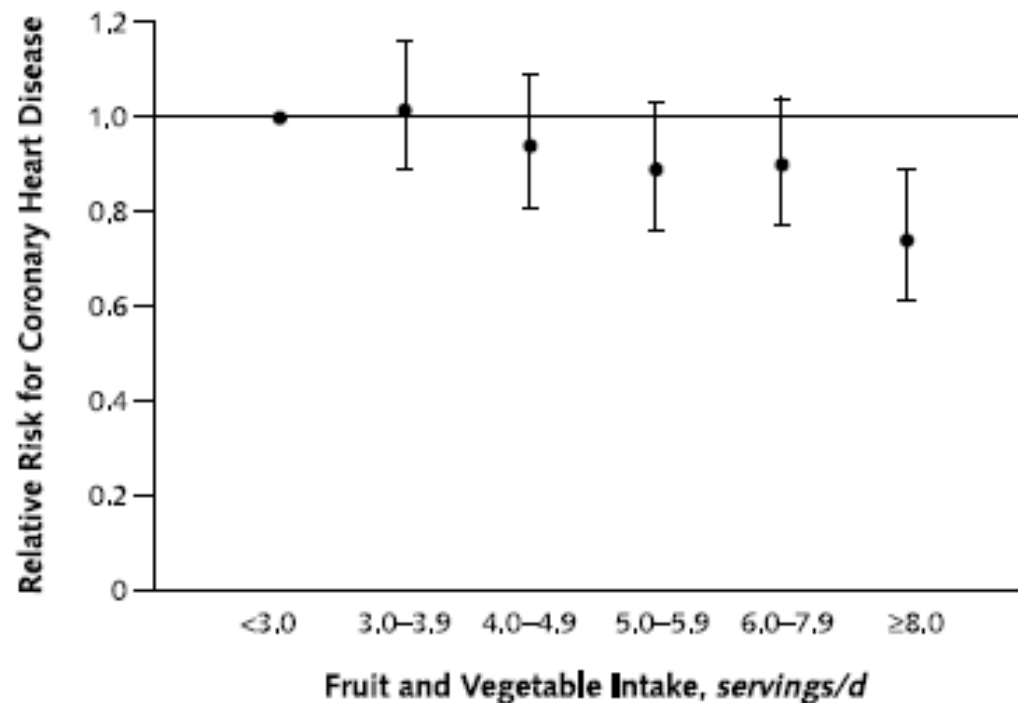
Better endothelial function with $p < 0.001$

Better CRP



Diet Evidence: Benefits of Fruits and Vegetables

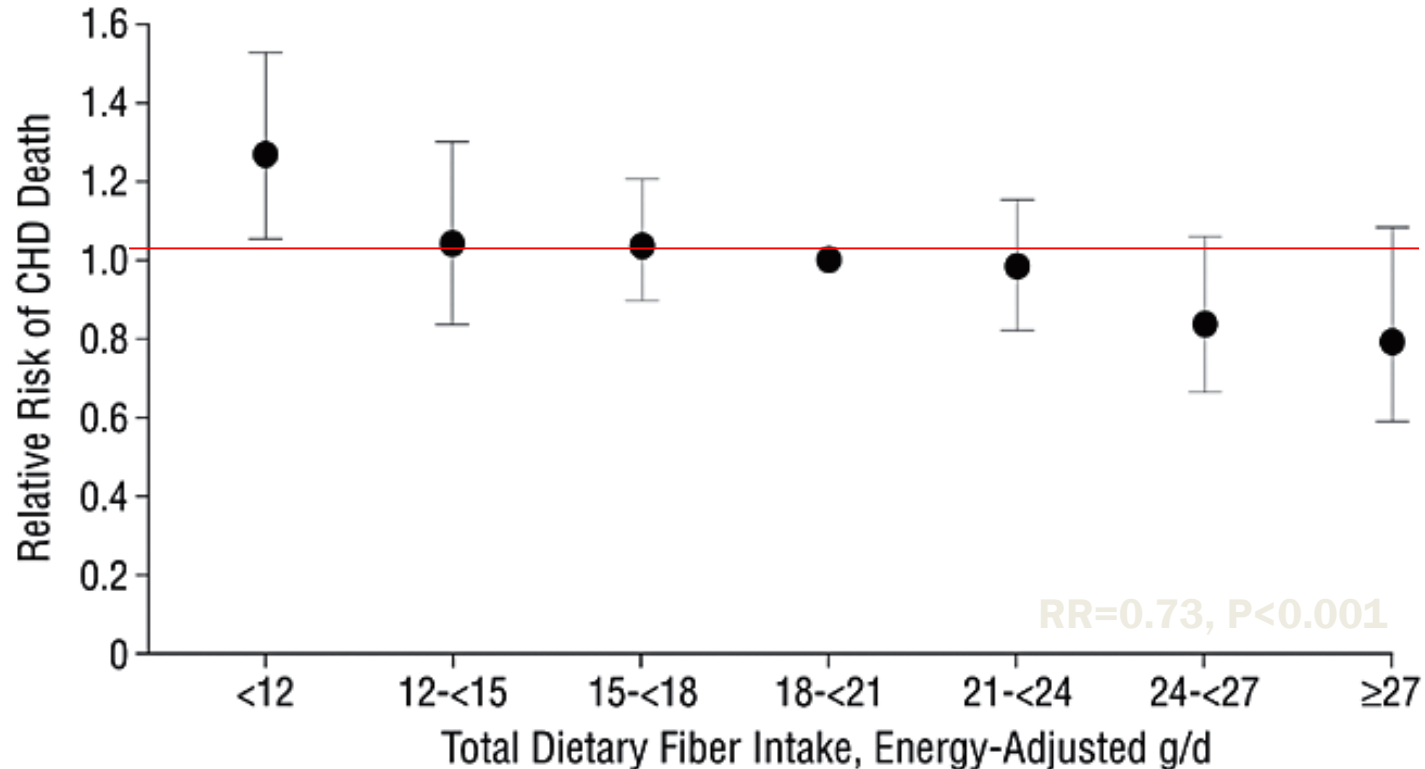
Nurses' Health Study and Health Professional's Follow-up Study
126,399 persons followed for 8-14 years to assess the relationship between fruit and vegetable intake and adverse CV outcomes*



Increased fruit and vegetable intake reduces CV risk

Diet Evidence: Benefits of Whole Grains and Fiber

336,244 persons followed for 6-10 years to assess the relationship between dietary fiber intake and adverse CV outcomes



Increased dietary fiber intake reduces CV risk

At least 3 dietary strategies are effective in preventing CHD

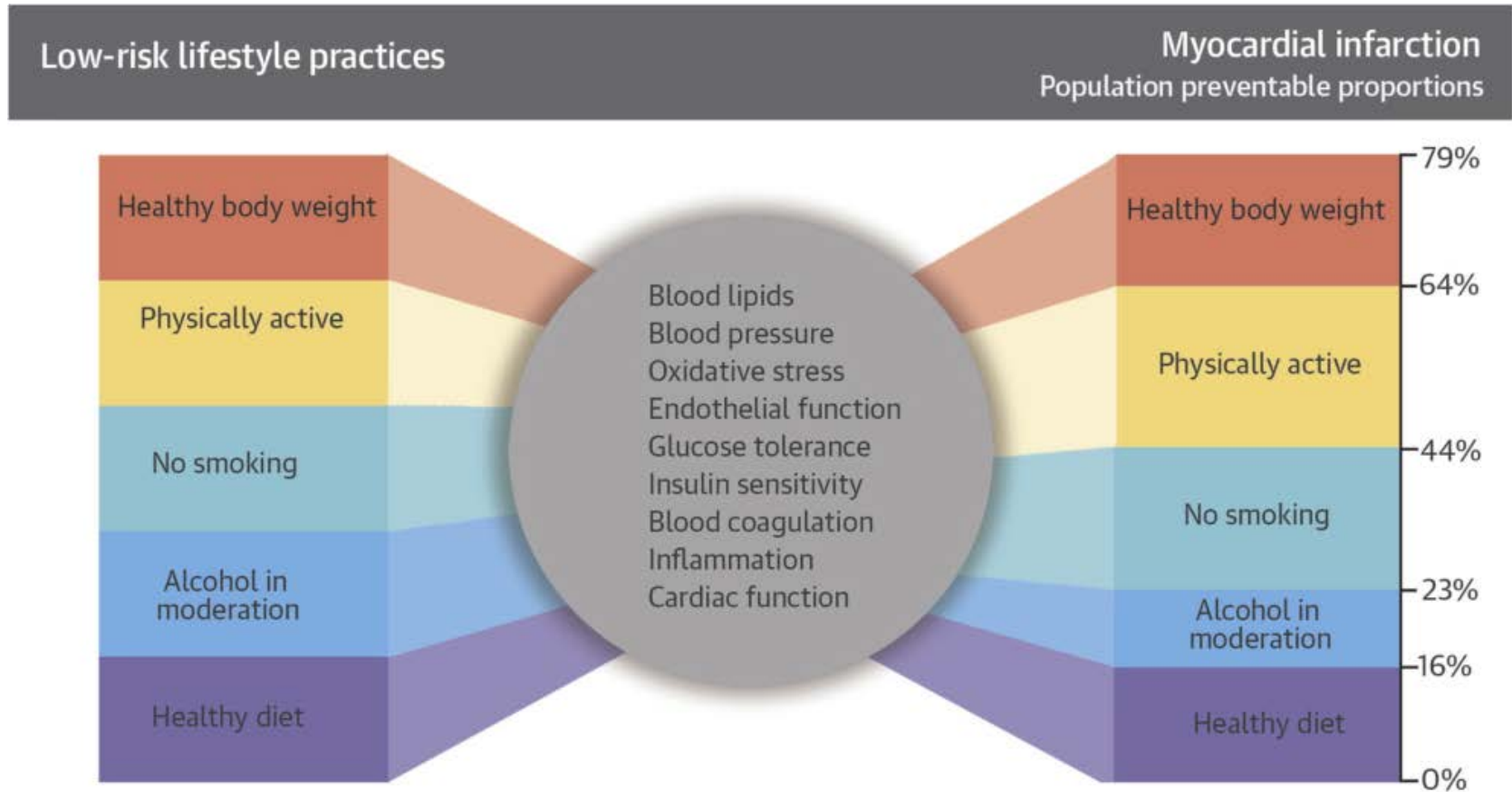
- Substitute nonhydrogenated unsaturated fats for saturated and *trans*-fats.
- Increase consumption of omega-3 fatty acids from fish, fish oil supplements, or plant sources.
- Consume a diet high in fruits, vegetables, nuts, and whole grains and low in refined grain products.

Simply lowering the percentage of energy from total fat in the diet is unlikely to improve lipid profile or reduce CHD incidence

Low-Risk Diet and Lifestyle Habits in the Primary Prevention of Myocardial Infarction in Men: A Population-Based Prospective Cohort Study

- Prospective cohort of 20,721 Swedish men followed from 1997 through 2009.
- Low-risk behavior included 5 factors: a healthy diet (top quintile of Recommended Food Score), moderate alcohol consumption (10 to 30 g/day), no smoking, being physically active (walking/bicycling ≥ 40 min/day and exercising ≥ 1 h/week), and having no abdominal adiposity (waist circumference < 95 cm).

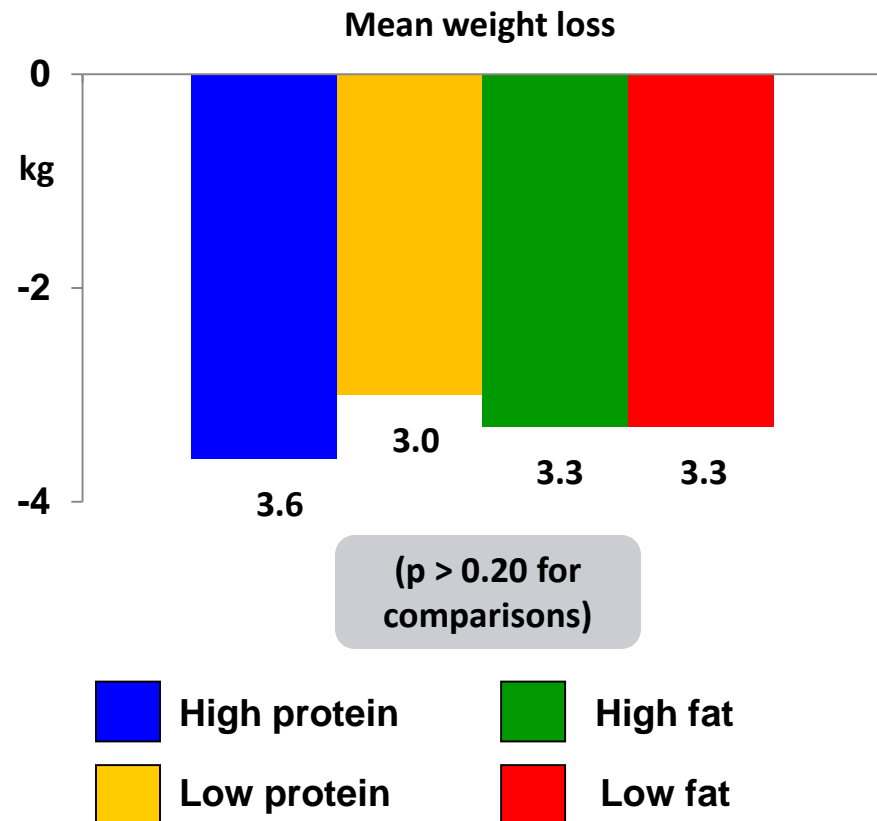
Almost 4 of 5 MIs in men may be preventable with a combined low-risk behavior.



Åkesson, PhD et al. *J Am Coll Cardiol.* 2014;64(13):1299-1306.

Comparison of Weight-Loss Diets

Trial design: Overweight adults were randomized to: 1) low-fat, average-protein diet (n = 204); 2) low-fat, high-protein diet (n = 202); 3) high-fat, average-protein diet (n = 204); or 4) high-fat, high-protein diet (n = 201). Follow-up was 2 years.



Results

- Weight loss: 3.6 kg for high-protein diet and 3.0 kg for low-protein diet (p = 0.22)
- Similarly, weight loss was: 3.3 kg for high-fat diet and 3.3 kg for low-fat diet (p = 0.94)
- Among the 80% who completed the trial, mean weight loss was 4 kg

Conclusions

- Among overweight patients, a reduced calorie diet is principally important for long-term weight loss
- The proportion of fat, protein, and carbohydrates in the diet appears to be less important for weight loss

Sacks FM, et al. N Engl J Med
2009;360:859-73

- What mostly matters is reduced calories

Overweight and Obese States: Definition Using the Body Mass Index (BMI)

Defined by Body Mass Index = $(703.1) * \text{Wt (lbs)} / \text{Ht}^2 \text{ (in)}$

Weight Category	BMI (kg/m ²)
Normal	18.5-24.9
Overweight*	25.0-29.9
Obesity (Class I)	30.0-34.9
Obesity (Class II)	35.0-39.9
Obesity (Class III)	<u>≥</u> 40.0

*Measurement of waist circumference is most helpful in this category

Source: *The Practical Guide: Identification, Evaluation, and Treatment of Overweight and Obesity in Adults*. NIH/NHLBI/NAASO. October, 2000. NIH publication No. 00-4084

Diet Evidence: Types of Treatment Programs

Very low fat

- **Ornish (Reversal diet and Prevention diet)**
 - **Vegetarian with 10% calories from fat. No cooking oils, avocados, nuts, and seeds. High fiber. No caloric restriction.**
- **Pritikin**
 - **Very low-fat (primarily vegetarian) diet based on whole grains, fruits, and vegetables**

Intermediate

- **Sugar Busters**
 - **30% protein, 40% fat, 30% carbohydrates (low glycemic index)**
- **Zone**
 - **30% protein, 30% fat, 40% carbohydrates**

Diet Evidence:

Types of Treatment Programs (Continued)

Very low carbohydrate

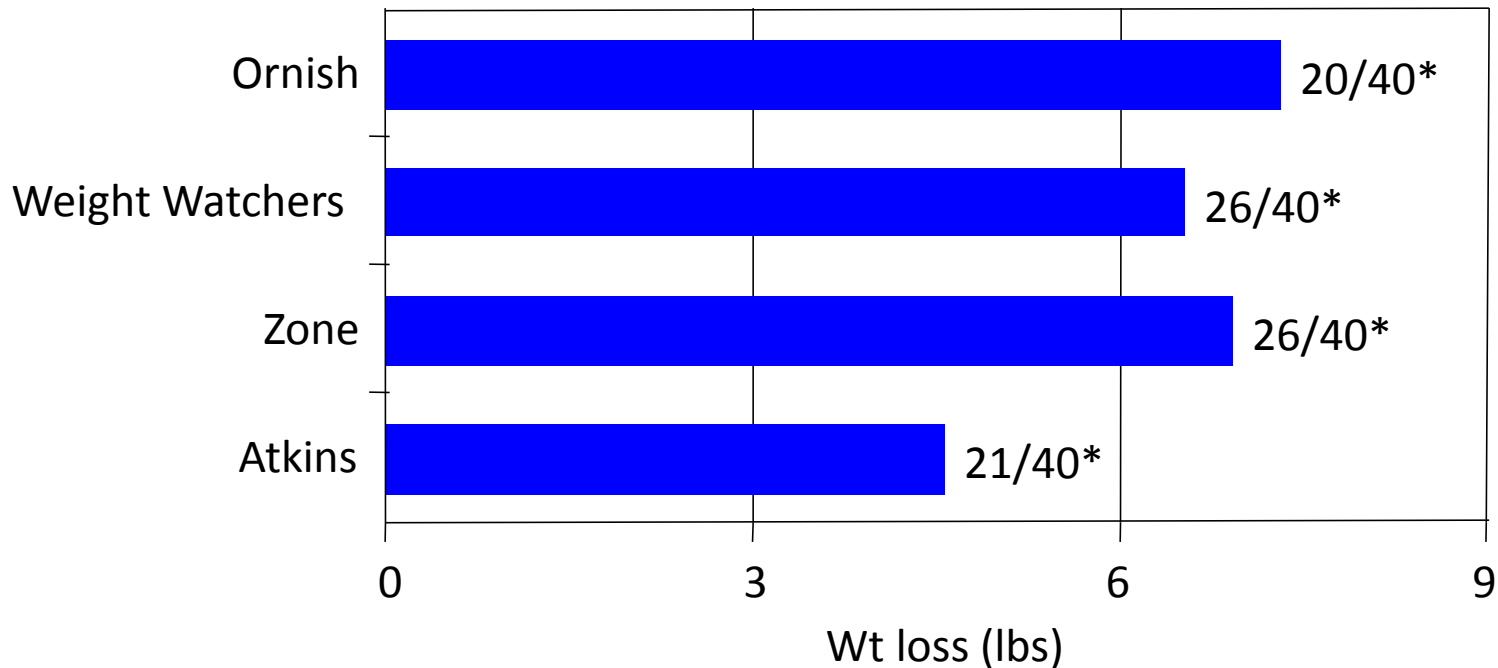
- **Atkins (Induction and Maintenance)**
 - **1st 2 weeks (≤ 20 grams of carbohydrates/day with no high glycemic foods).**
 - **Then can add 5 grams of carbohydrates/day each week to maximum of 90 grams of carbohydrates/day long term.**
- **South Beach (3 Phases)**
 - **1st phase (2 weeks) significantly restricts carbohydrates**
 - **2nd phase reintroduces low glycemic carbohydrates**
 - **3rd phase attempts to maintain weight**

Caloric restriction

- **Weight watchers**
 - **Assigns foods a point value and restricts the number of points that can be consumed/day**

Diet Evidence: Primary Prevention

160 overweight and obese patients randomized to the Atkins, Zone, Weight Watchers, or Ornish diets for 1 year

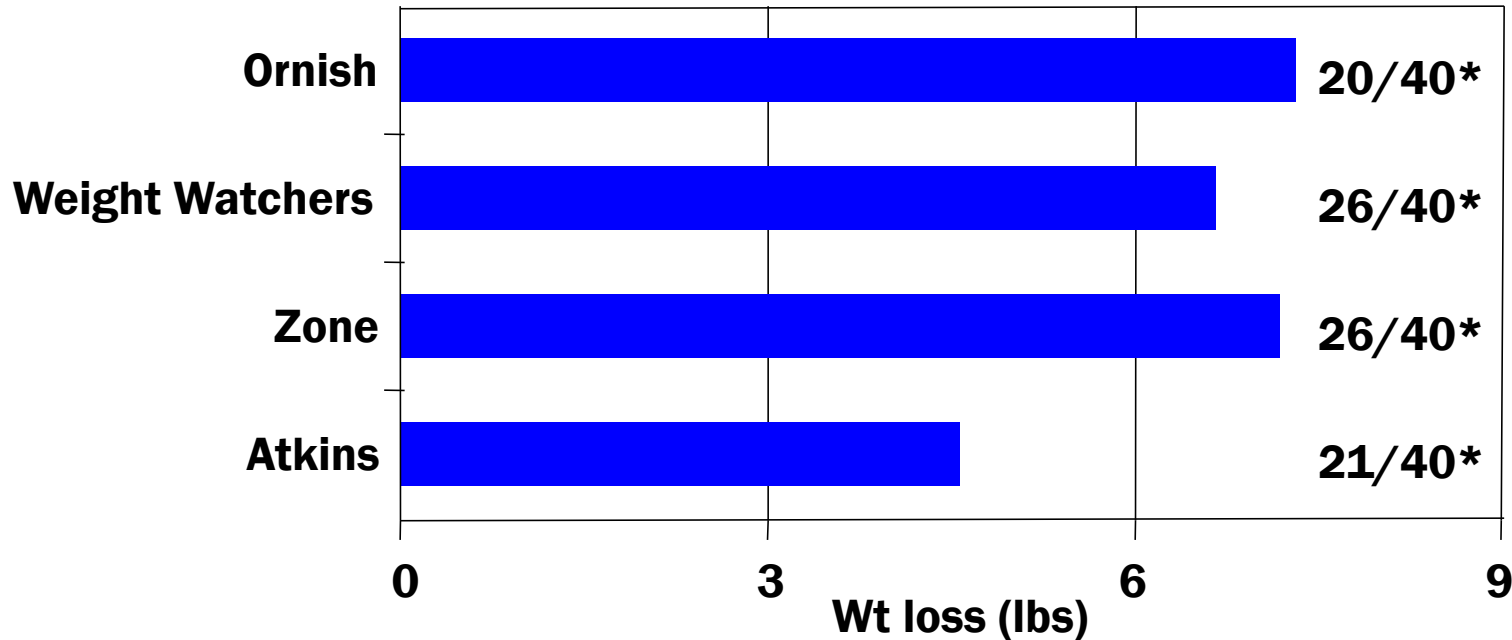


Weight loss is similar among diet programs, but hard to sustain because of poor long-term compliance

*Ratio of individuals completing the study to those enrolled

Diet Evidence: Primary Prevention

160 overweight and obese patients randomized to the Atkins, Zone, Weight Watchers, or Ornish diets for 1 year



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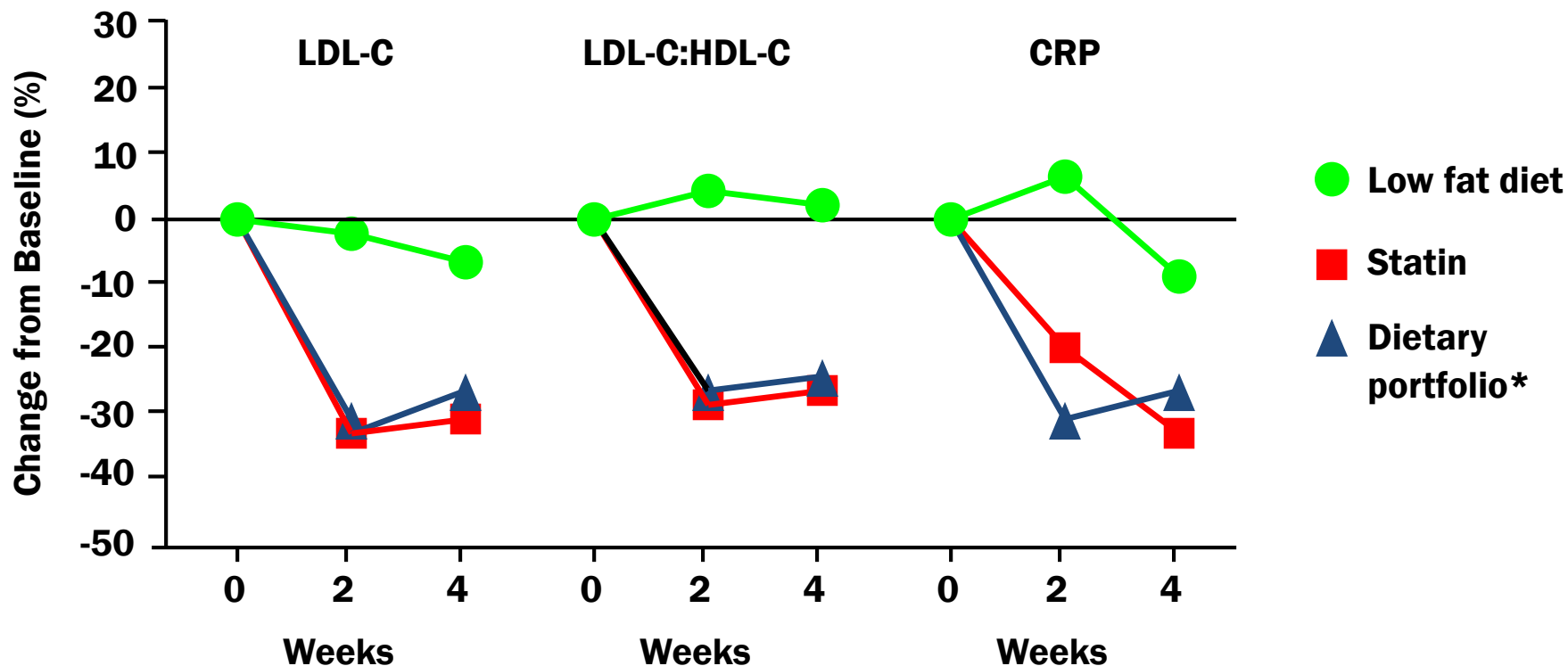
Source: Dansinger, ML et al. *JAMA* 2005;293:43-53

Evidence for Current Cardiovascular Disease Prevention Guidelines

Diet Evidence, Cardiovascular Events, and Guidelines

Diet Evidence: Effect on Lipid Parameters and CRP

46 dyslipidemic patients randomized to a low fat diet, a low fat diet and lovastatin (20 mg), or a dietary portfolio* for 4 weeks



A diversified diet improves lipid parameters and CRP levels

*Enriched in plant sterols, soy protein, viscous fiber, and almonds

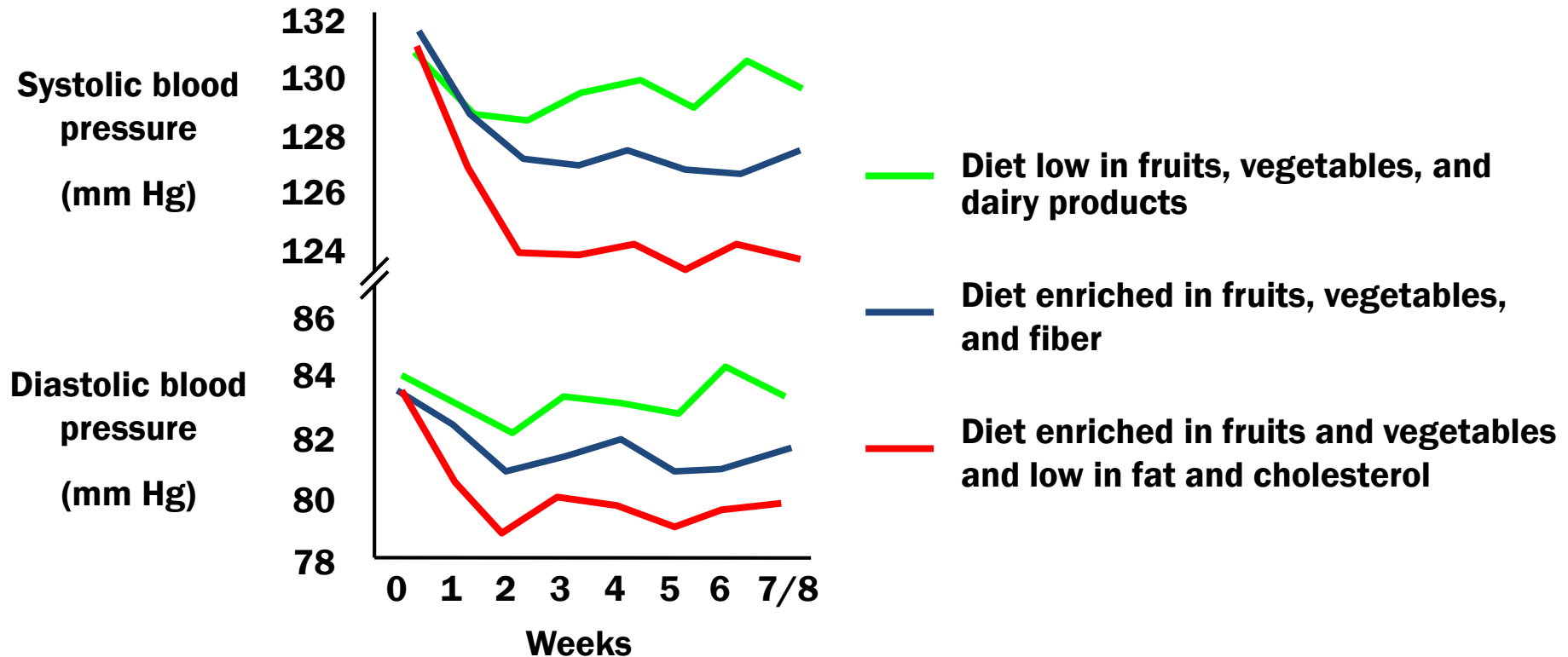
CRP=C-reactive protein, HDL-C=High density lipoprotein cholesterol,
LDL-C=Low density lipoprotein cholesterol

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

Diet Evidence: Effect on Blood Pressure

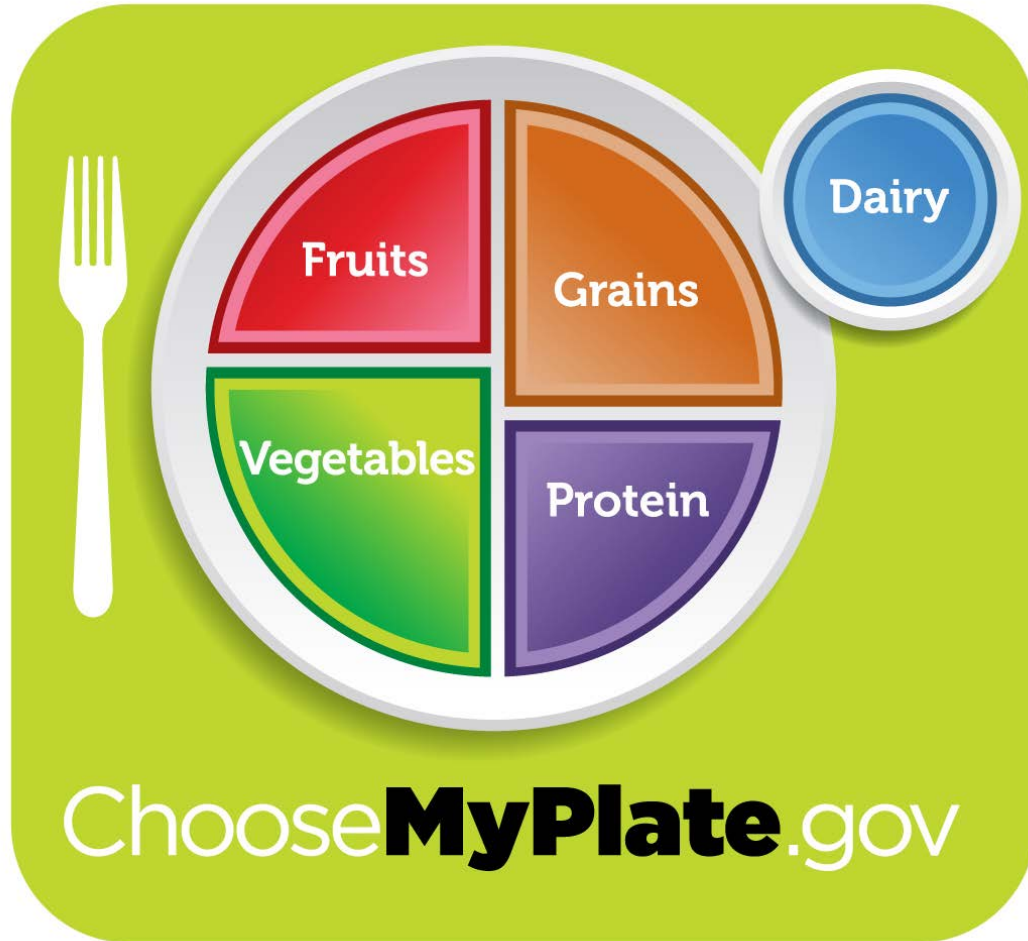
Dietary Approaches to Stop Hypertension (DASH) Group

459 hypertensive patients randomized to 1 of 3 diets for 8 weeks



A diversified diet improves blood pressure

Diet Evidence: Making Smart Food Choices



- **Helps consumers make better food choices**
- **Reminds individuals to eat healthfully**
- **Illustrates the 5 food groups using a mealtime visual**
- **Selected messages include:**
 - **Balancing calories**
 - **Foods to increase**
 - **Foods to reduce**

Diet Evidence: Primary Prevention

22,043 adults evaluated for adherence to a Mediterranean diet, with points given for high consumption of vegetables, legumes, fruits, nuts, cereal, and fish and points subtracted for high consumption of meat, poultry, and dairy

Variable	# of Deaths/ # of Participants	Fully Adjusted Hazard Ratio (95% CI)
Death from any cause	275/22,043	0.75 (0.64-0.87)
Death from CHD	54/22,043	0.67 (0.47-0.94)
Death from cancer	97/22,043	0.76 (0.59-0.98)

High adherence to a Mediterranean diet is associated with a reduction in death

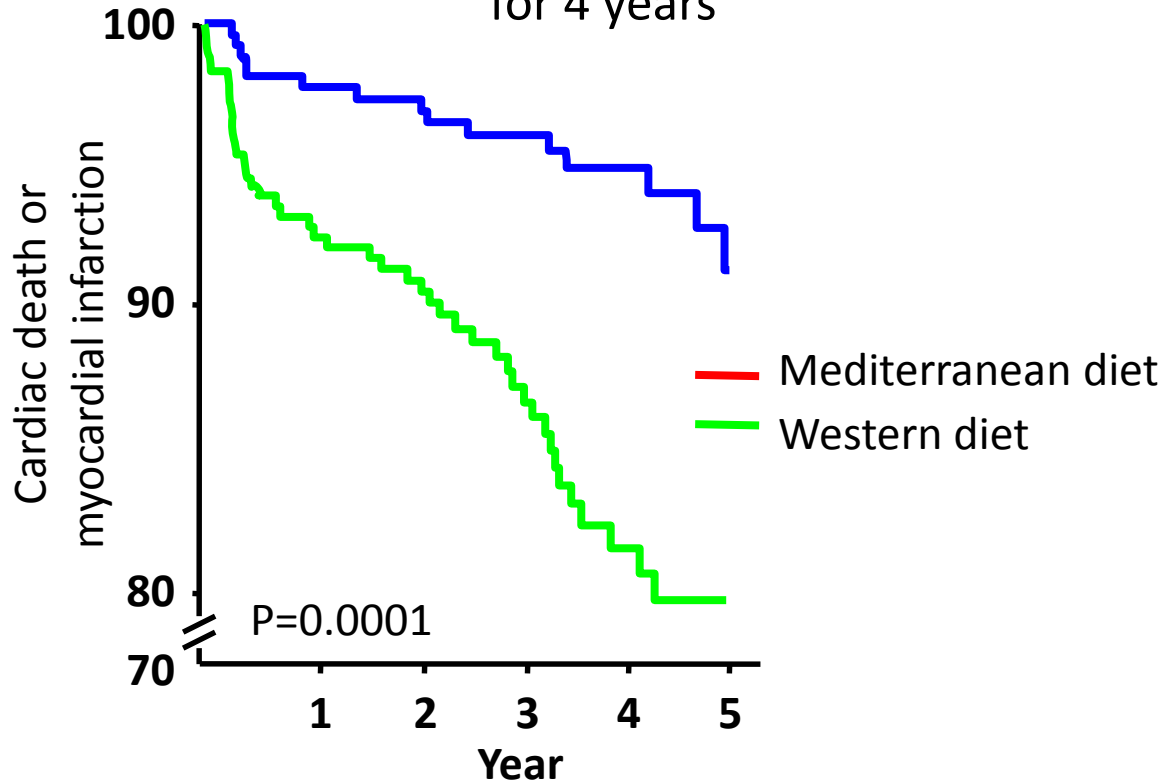
CHD=Coronary heart disease

Source: Trichopoulos A et al. *NEJM* 2003;348:2599-2608

Diet Evidence: Secondary Prevention

Lyon Diet Heart Study

605 patients following a MI randomized to a Mediterranean* or Western** diet for 4 years



A "Mediterranean" diet reduces CVD event rates

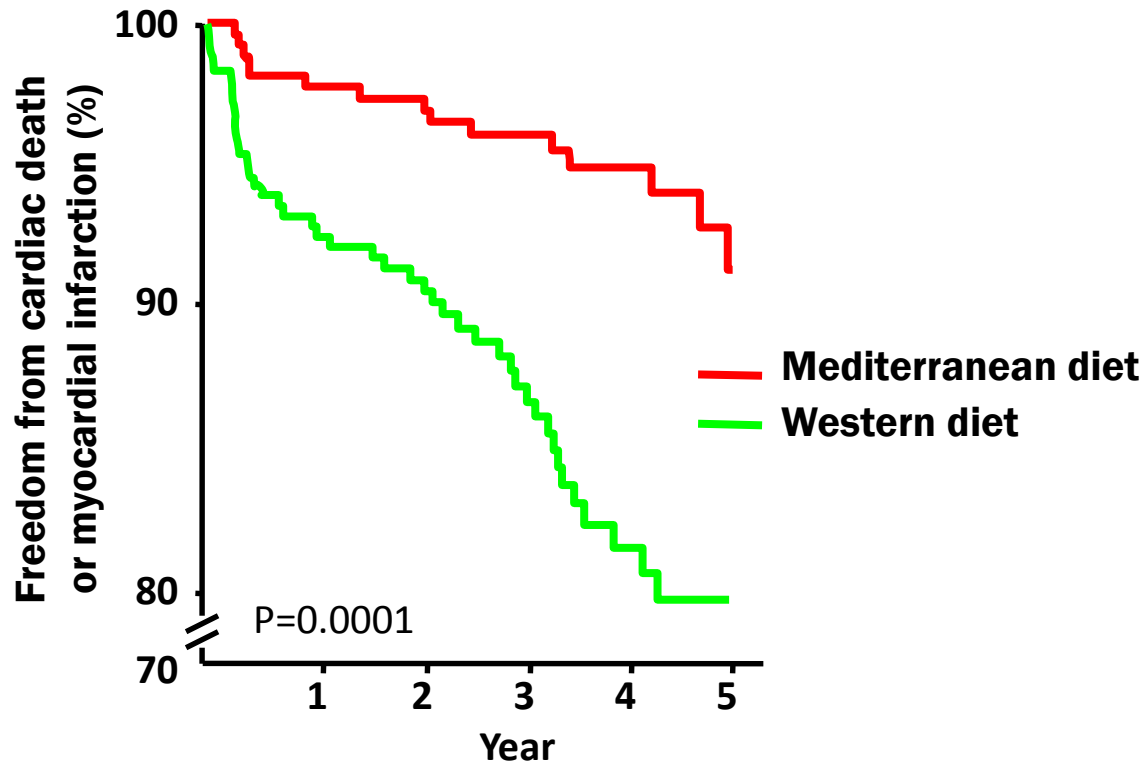
*High in polyunsaturated fat and fiber

**High in saturated fat and low in fiber

Diet Evidence: Secondary Prevention

Lyon Diet Heart Study

605 patients following a myocardial infarction randomized to a Mediterranean* or Western** diet for 4 years



A Mediterranean diet reduces cardiovascular events

*High in polyunsaturated fat and fiber,
**High in saturated fat and low in fiber

Source: De Lorgeril M et al. *Circulation* 1999;99:779-785

Adult Treatment Panel (ATP) III Dietary Recommendations

Nutrient	Recommended Intake
Saturated fat*	<7% of total calories
Polyunsaturated fat	Up to 10% of total calories
Monounsaturated fat	Up to 20% of total calories
Total fat	25%–35% of total calories
Carbohydrate (esp. complex carbs)	50%–60% of total calories
Fiber	20–30 g/d
Protein	~15% of total calories
Cholesterol	<200 mg/d

*Trans fatty acids also raise LDL-C and should be kept at a low intake
Note: Regarding total calories, balance energy intake and expenditure to maintain desirable body weight

LDL-C=Low density lipoprotein cholesterol

Source: Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults. *JAMA* 2001;285:2486-2497

American Heart Association Nutrition Committee Dietary Recommendations

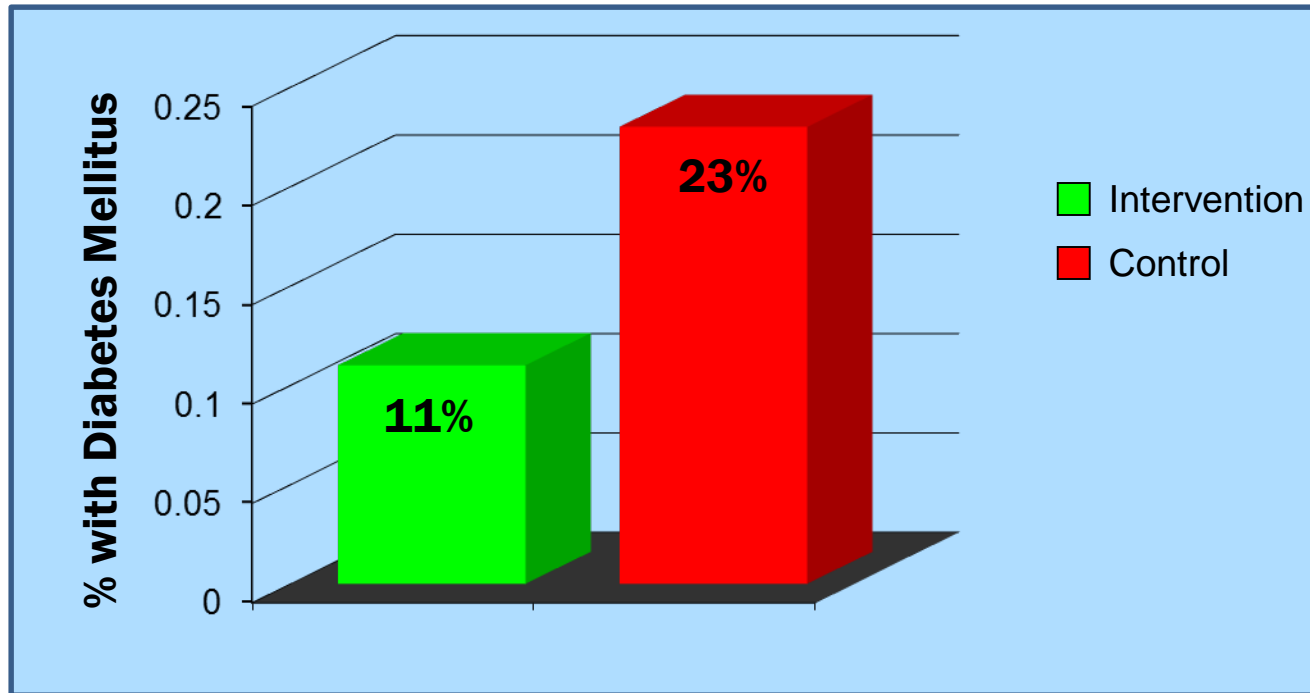
Recommendations for Cardiovascular Disease Risk Reduction

- **Balance calorie intake and physical activity to achieve or maintain a healthy body weight**
 - **Consume a diet rich in fruits and vegetables**
 - **Consume whole-grain, high-fiber foods**
 - **Consume fish, especially oily fish, at least twice a week**
 - **Limit intake of saturated fat to <7%, trans fat to <1% of energy, and cholesterol <300 mg/day by:**
 - **Choosing lean meat and vegetable alternatives**
 - **Choosing fat free (skim), 1% fat, and low-fat dairy products,**
 - **Minimizing intake of partially hydrogenated fats**
 - **Minimize intake of beverages and foods with added sugar**
 - **Choose and prepare foods with little or no salt**
 - **If alcohol is consumed, do so in moderation**
-

Pre-Diabetic Conditions: Benefit of Lifestyle Modification

Finnish Diabetes Prevention Study

522 overweight and obese (mean BMI 31 kg/m²) patients with impaired fasting glucose[†] randomized to intervention[‡] or usual care for 3 years



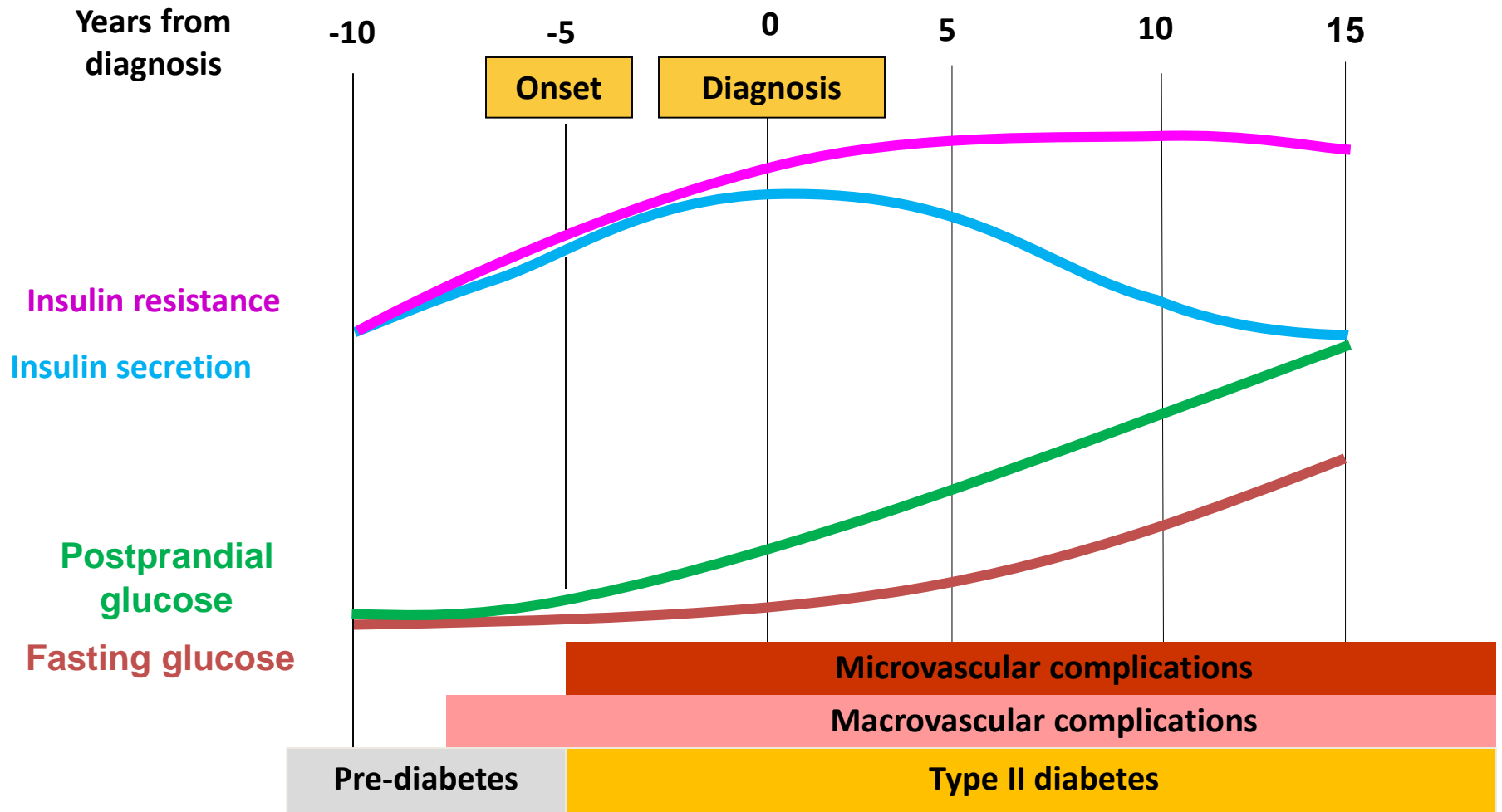
Lifestyle modification reduces the risk of developing diabetes mellitus

[†]Defined as a glucose ≥ 140 mg/dl 2 hours after an oral glucose challenge

[‡]Aimed at reducing weight ($\geq 5\%$), total intake of fat ($< 30\%$ total calories) and saturated fat ($< 10\%$ total calories); increasing uptake of fiber (≥ 15 g/1000 cal); and physical activity (moderate at least 30 min/day)

Source: Tuomilehto J et al. *NEJM* 2001;344:1343-1350

Natural History of Type II Diabetes Mellitus



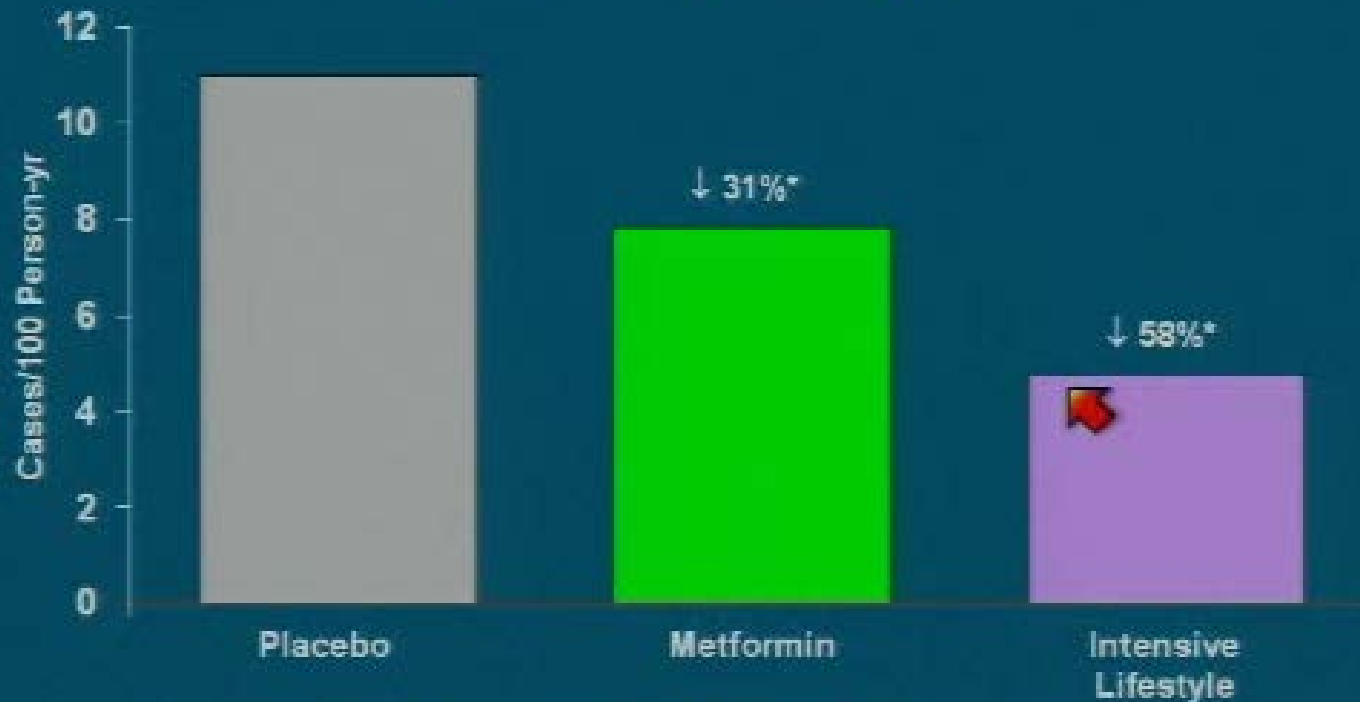
Sources:

Ramlo-Halsted BA et al. *Prim Care*. 1999;26:771-789

Nathan DM et al. *NEJM* 2002;347:1342-1349

Diabetes Prevention Program: Progression to Type 2 Diabetes

Average Follow-up of 2.8 yr



The Diabetes Prevention Program Research Group. *N Engl J Med.* 2002;346:393

Background

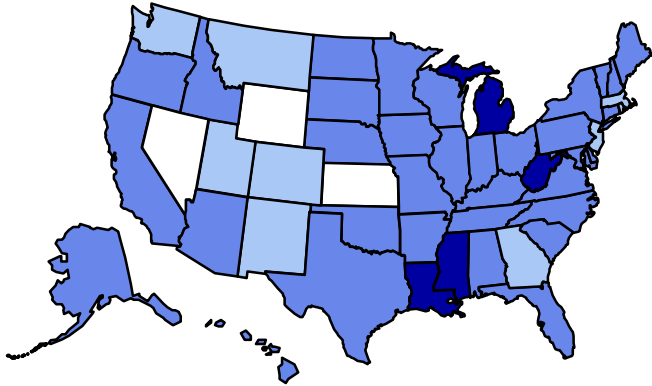
- Obesity is associated with a low-grade state of chronic inflammation that may be causally related to cardiometabolic disease.

Common Aspects of the OmniHeart Trial Diets (at 2100 kcal)

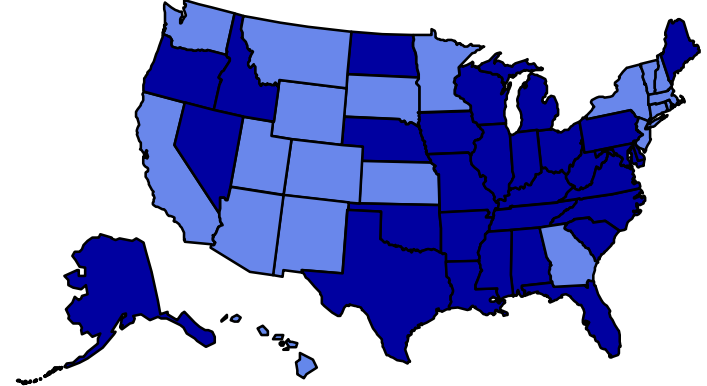
- cholesterol 150 mg/day
- fiber 30 g/day
- sodium 2,300 mg (100 mmol)/day
- potassium 4,700 mg (120 mmol)/day
- magnesium 500 mg/day
- calcium 1,200 mg/day

Prevalence of Obesity in U.S. Adults

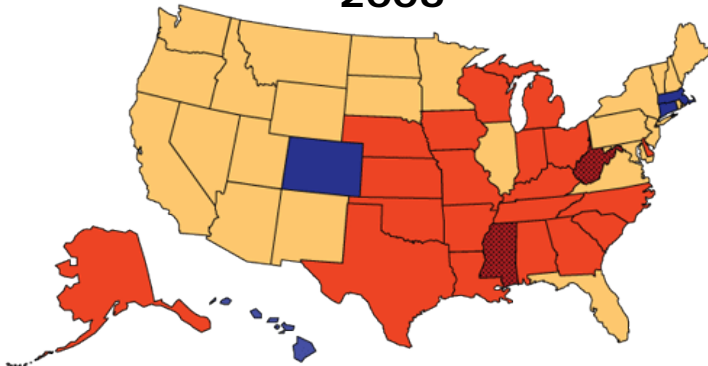
1991



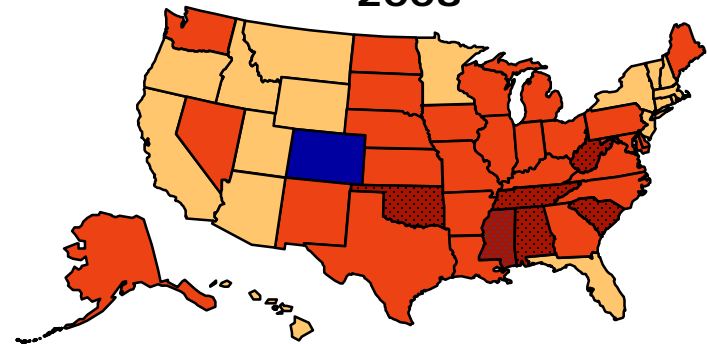
1996



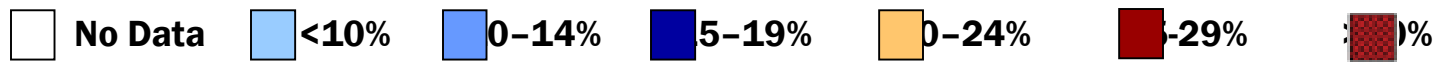
2006



2008

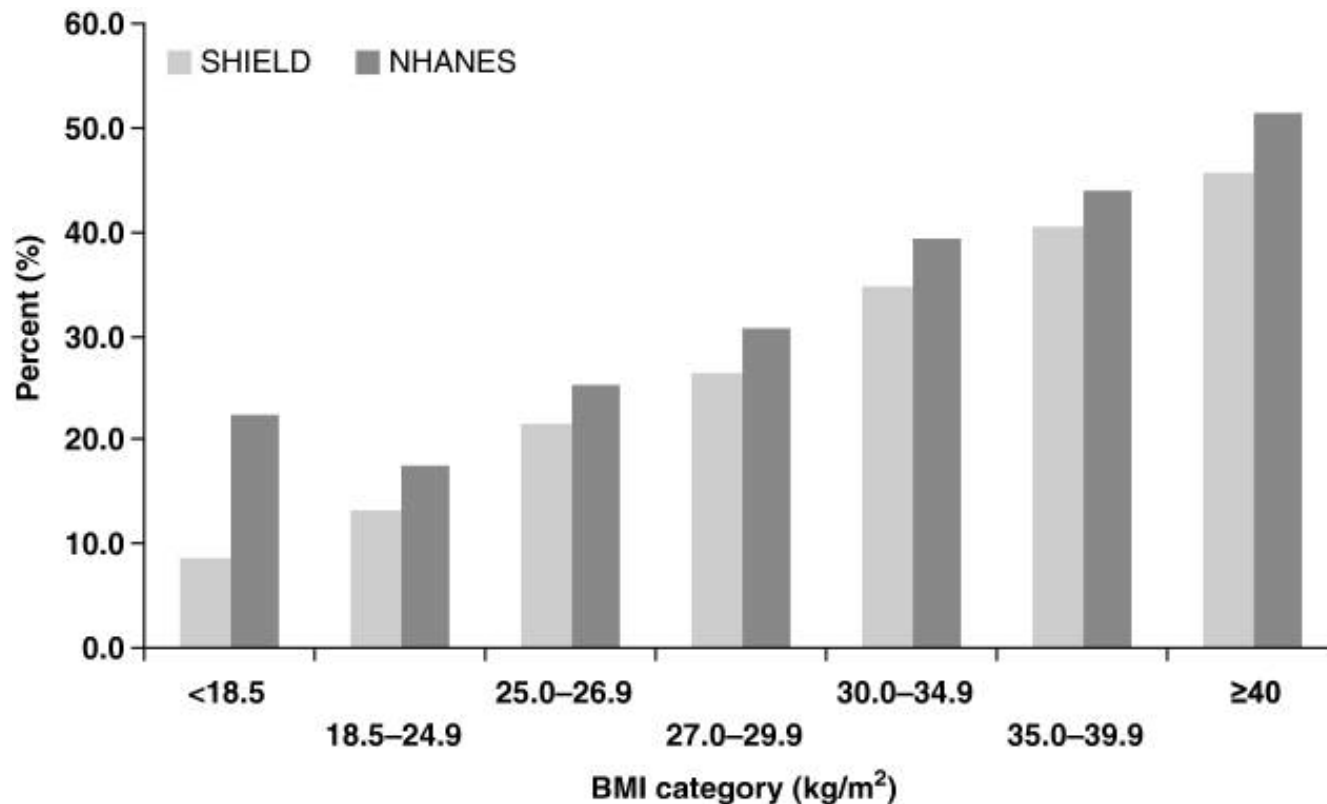


Percentage of State Obese (BMI \geq 30)



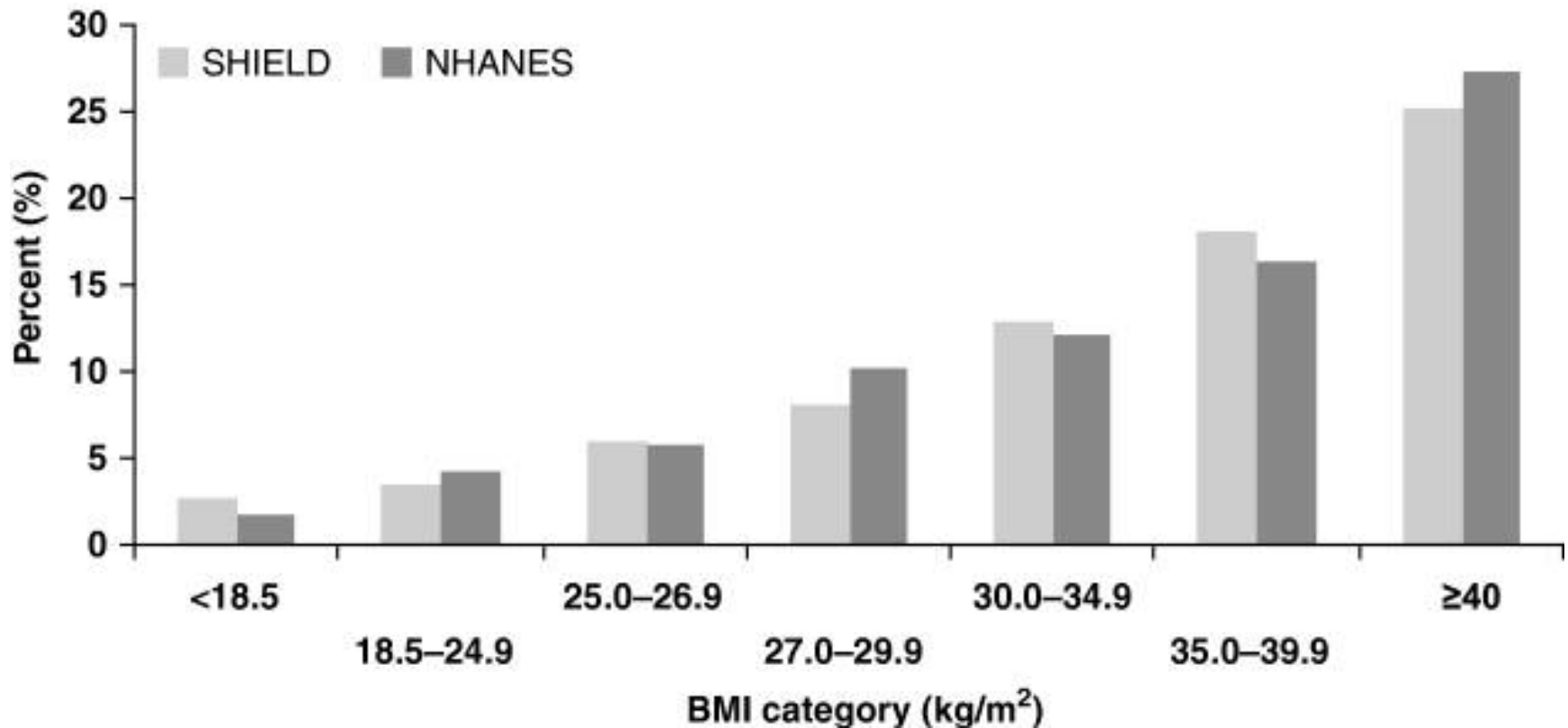
Body Mass Index: Risk of Hypertension

Study to Help Improve Early Evaluation and Management of Risk Factors Leading to Diabetes (SHIELD) and National Health and Nutrition Examination Survey (NHANES)

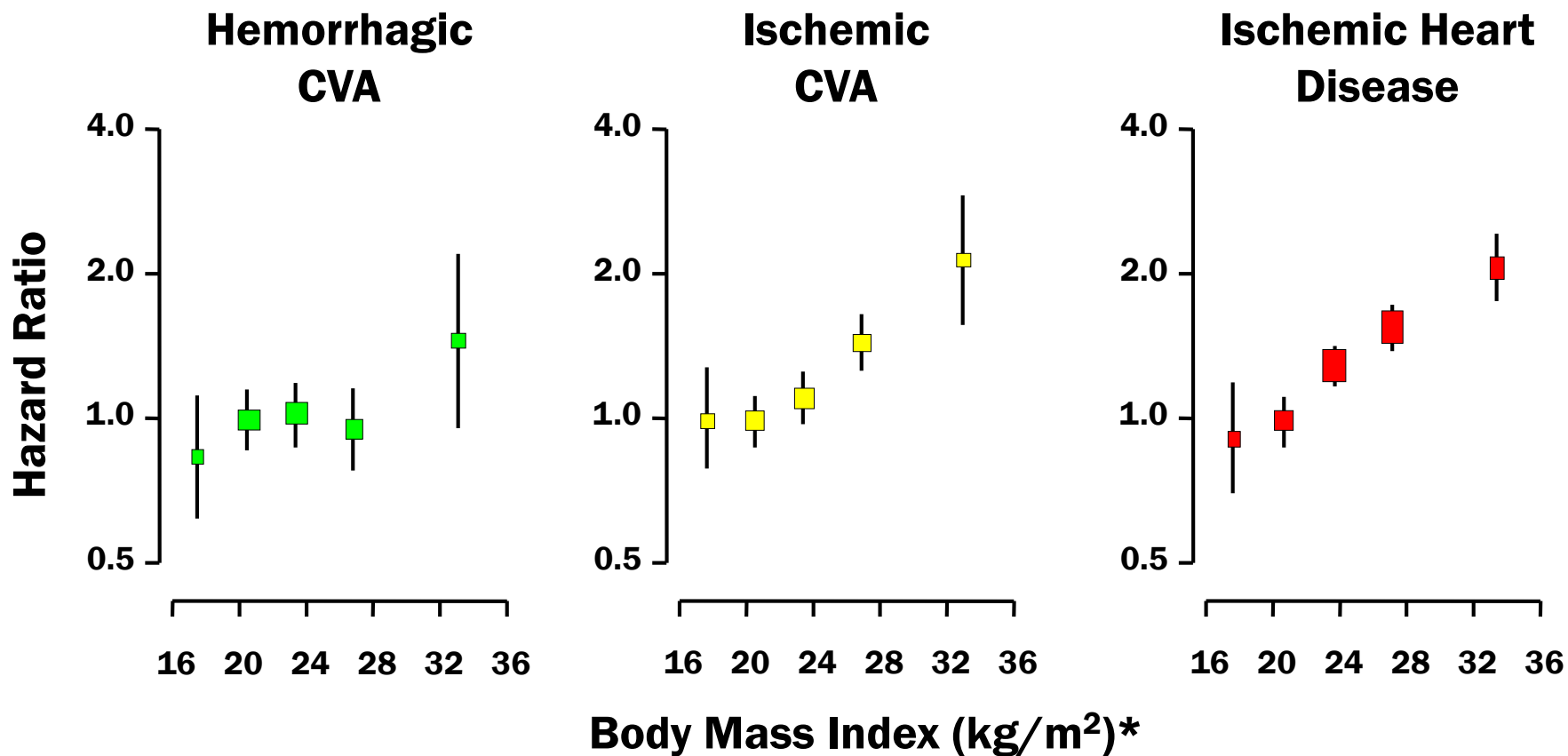


Body Mass Index: Risk of Diabetes Mellitus

Study to Help Improve Early Evaluation and Management of Risk Factors Leading to Diabetes (SHIELD) and National Health and Nutrition Examination Survey (NHANES)



Body Mass Index: Risk of Cardiovascular Disease



*BMI is calculated as the weight in kg divided by the BSA in meters²

CVA=Cerebrovascular accident

Source: Mhurchu N et al. *Int J Epidemiol* 2004;33:751-758



From: Low-Risk Diet and Lifestyle Habits in the Primary Prevention of Myocardial Infarction in Men: A Population-Based Prospective Cohort Study

J Am Coll Cardiol. 2014;64(13):1299-1306. doi:10.1016/j.jacc.2014.06.1190

	Recommended Food Score	
	Quintiles 1-4	Quintile 5
Mean age, yrs	59	57
Nondietary factors		
Post-secondary education	18	26
Married/cohabitating	83	90
Family history of myocardial infarction	16	15
Aspirin use	28	31
No smoking†	56	67
Walking/bicycling for ≥40 min/day and exercising for ≥1 h/week	29	32
Mean waist circumference, cm	95	94
Mean alcohol consumption, g/day	13	14
Dietary factors, mean		
Mean non-Recommended Food Score‡	15	17
Mean energy intake, kcal/day	2,700	2,900
Food intake/day, mean servings		
Vegetables	2.3	3.2
Tab Fruits	1.2	1.6
Legumes	0.3	0.3
Base Whole grains	3.7	4.3
Fish/week	1.7	2.3

en by Categories of Recommended Food Score*

- Table 2 Relative Risk of Myocardial Infarction Associated With Modifiable Lifestyle Factors in 20,721 Men

Lifestyle Factors	Low-Risk Group	RR* (95% CI)	Model 1	Model 2†
Diet Low risk (Recommended Food Score‡ top quintile vs. the rest)	177 (18)	0.76 (0.65–0.90)	0.82 (0.69–0.96)	
Alcohol consumption Low risk (10–30 g/day vs. the rest)	448 (39)	0.92 (0.82–1.03)	0.89 (0.79–1.00)	
Smoking Low risk (no smoking vs. the rest)	689 (58)	0.63 (0.57–0.70)	0.64 (0.57–0.71)	
Physical activity Low risk (40 min/day walking/bicycling and 1 h vs. <1 h weekly exercise)	475 (30)	0.93 (0.83–1.05)	0.97 (0.86–1.09)	
Abdominal adiposity Low risk (<95 vs. ≥95 cm waist circumference)	632 (52)	0.87 (0.78–0.97)	0.88 (0.78–0.98)	
- Table Footer Note* Estimated from a multivariate Cox proportional hazards model adjusted for age (continuous), educational achievement (≤10, 10 to 12, >12 years), marital status (single, married/cohabiting, divorced, widowed), family history of myocardial infarction (yes/no), use of aspirin (yes/no), non-Recommended Food Score (quintiles), and total energy intake (continuous).
- Table Footer Note† Adjusted for covariates in Model 1 and mutually adjusted for all the other low-risk lifestyle factors.
- Table Footer Note‡ The Recommended Food Scores included foods with a beneficial effect on cardiovascular health. A score of 1, adding up to a maximum of 25, was assigned for regular consumption of fruits, vegetables, legumes, nuts, reduced-fat dairy products, whole grains, and fish.
- Table Footer Note Values are n (%) unless otherwise indicated. CI = confidence interval; RR = relative risk.



From: Low-Risk Diet and Lifestyle Habits in the Primary Prevention of Myocardial Infarction in Men: A Population-Based Prospective Cohort Study

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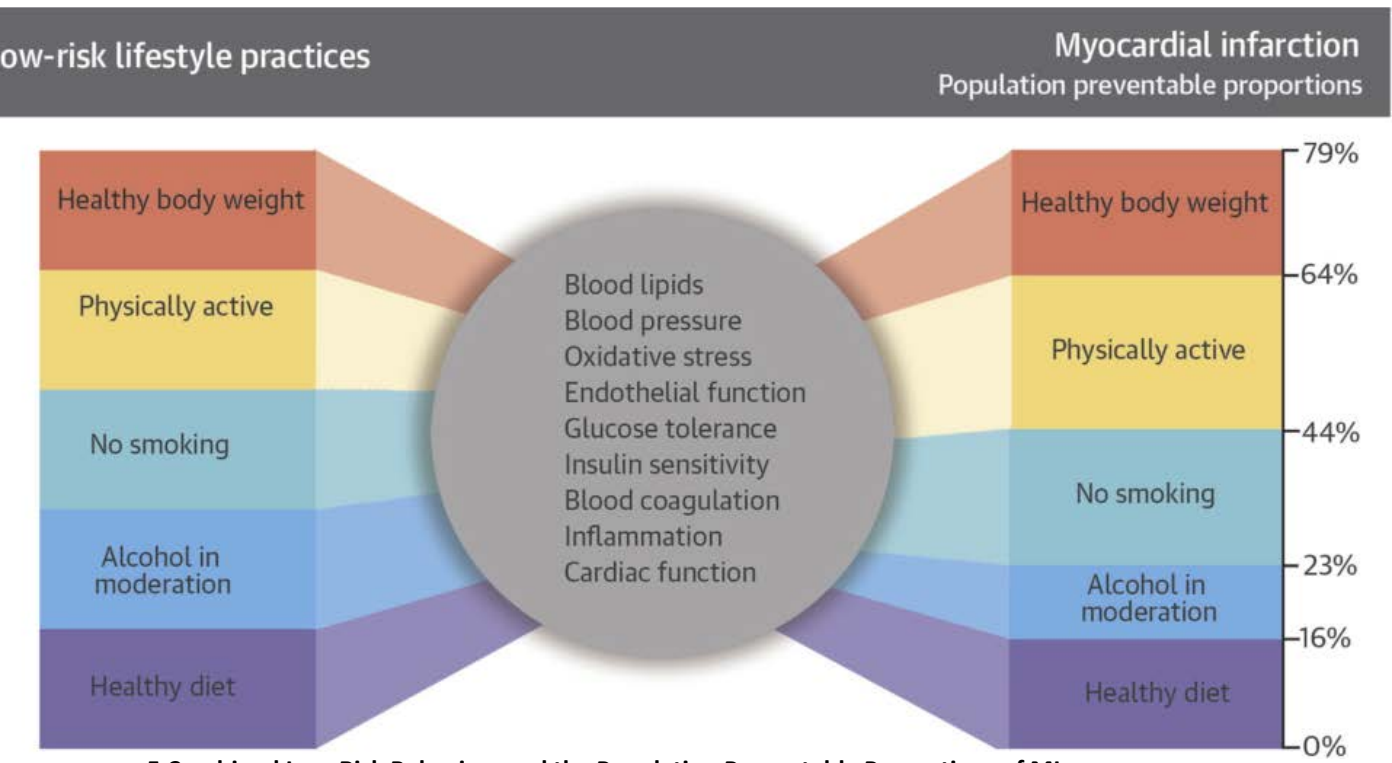
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Table Title:

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5 Combined Low-Risk Behaviors and the Population Preventable Proportions of MI

The combination of the 5 low-risk dietary and lifestyle factors, the proposed intermediate biological factors, and the population preventable proportions of myocardial infarction.