Food As Prevention in Cardiovascular Disease

McMaster Mini Medical School
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Gastroenterology Division
McMaster University
Subhas Ganguli – Conflict of Interest Slide

Last 2 years: None

No off-label uses of medications will be discussed.
I will be addressing the following questions:

1) Is there good evidence of a ‘signal’ for the role of diet in the prevention and/or treatment of:
   1) Atherosclerotic heart disease
   2) Risk factors for atherosclerosis
2) If so, what is the most effective dietary intervention
3) What is necessary for this intervention to succeed.
# Top 10 Causes of Death, USA, 2013

<table>
<thead>
<tr>
<th>Causes of Death</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ischemic heart disease</td>
<td>1 (20.3%)</td>
<td>1 (20.3%)</td>
</tr>
<tr>
<td>Alzheimer disease</td>
<td>2 (8.3%)</td>
<td>2 (12.7%)</td>
</tr>
<tr>
<td>Lung cancer</td>
<td>3 (7.4%)</td>
<td>4 (7.3%)</td>
</tr>
<tr>
<td>COPD*</td>
<td>4 (5.8%)</td>
<td>5 (5.6%)</td>
</tr>
<tr>
<td>Cerebrovascular disease</td>
<td>5 (5.0%)</td>
<td>6 (3.4%)</td>
</tr>
<tr>
<td>Lower respiratory infections</td>
<td>6 (3.0%)</td>
<td>7 (3.4%)</td>
</tr>
<tr>
<td>Diabetes</td>
<td>7 (2.8%)</td>
<td>8 (2.8%)</td>
</tr>
<tr>
<td>Prostate cancer</td>
<td>8 (2.8%)</td>
<td>9 (2.6%)</td>
</tr>
<tr>
<td>Chronic kidney disease</td>
<td>9 (2.7%)</td>
<td>10 (2.5%)</td>
</tr>
<tr>
<td>Colorectal cancer</td>
<td>10 (2.6%)</td>
<td>-</td>
</tr>
</tbody>
</table>

*Chronic obstructive pulmonary disease

Parenthetical data indicate percentage of total deaths.
<table>
<thead>
<tr>
<th></th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Dietary</td>
<td>Dietary</td>
</tr>
<tr>
<td>2</td>
<td>Smoking</td>
<td>Blood Pressure</td>
</tr>
<tr>
<td>3</td>
<td>Blood Pressure</td>
<td>Smoking</td>
</tr>
<tr>
<td>4</td>
<td>Body Mass Index</td>
<td>Body Mass Index</td>
</tr>
<tr>
<td>5</td>
<td>Blood Glucose</td>
<td>Blood Glucose</td>
</tr>
<tr>
<td>6</td>
<td>Total Cholesterol</td>
<td>Total Cholesterol</td>
</tr>
<tr>
<td>7</td>
<td>Physical Activity</td>
<td>Physical Activity</td>
</tr>
<tr>
<td>8</td>
<td>Kidney Function</td>
<td>Kidney Function</td>
</tr>
<tr>
<td>9</td>
<td>Air Pollution</td>
<td>Air Pollution</td>
</tr>
<tr>
<td>10</td>
<td>Occupational Risks</td>
<td>EtOH / Drugs</td>
</tr>
</tbody>
</table>
Hierarchy of Research Designs

- Randomized Controlled Double Blind Studies
- Cohort Studies
- Case Control Studies
- Case Series
- Case Reports
- Ideas, Editorials, Opinions
- Animal research
- In vitro (‘test tube’) research

Source: Guide to Research Methods: The Evidence Pyramid
SUNY Downstate Medical Center
Medical Research Library of Brooklyn EBM Resources
Important Safety Information about Lifestyle Changes

A whole food plant-based diet can reverse conditions such as high blood pressure or diabetes. When this happens, medication doses need to be reduced or there may be complications due to low blood pressure or low blood sugar such as fainting.

Always consult your physician before making diet, or medication changes or starting an exercise program.

Subjects on a WFPB diet need to supplement with vitamin B12 which is essential for the function of nerves and should consider supplementation with vitamin D and omega 3 (DHA, EPA).
How Important is Lifestyle
Healthy Lifestyle Factors & US Life Expectancy


Design: prospective cohort study of:
- 78,865 women from NHS followed for 34 yrs (1980-2014)
- 44,354 men from HPFUS followed for 27 yrs (1986-2014)

Low risk lifestyle factors:
1) Never smoking
2) BMI 18.5-24.9
3) >= 30 min/d moderate/vigorous physical activity
4) Moderate alcohol intake (5-15 g women, 5-30 g men)
5) High diet quality score (upper 40%)

Total lifestyle score: 0-5 scale
Healthy Lifestyle Factors & US Life Expectancy
Alternate Healthy Eating Index Score

Assigned points (0 to 10) for intake of each of 10 components:

High intake of:
1) Vegetables
2) Fruits
3) Nuts
4) Whole grains
5) Polyunsaturated fats
6) Omega 3 fatty acids

Low intake of:
7) Red meats
8) Processed meats
9) Sugar sweetened beverages
Healthy Lifestyle Factors & US Life Expectancy
Life Expectancy at 50 Yrs of Age

<table>
<thead>
<tr>
<th></th>
<th>0 of 5</th>
<th>5 of 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Women</td>
<td>79</td>
<td>93.1</td>
</tr>
<tr>
<td>Men</td>
<td>75.5</td>
<td>87.6</td>
</tr>
</tbody>
</table>

Y Li Circulation 2018 in press
DOI: 10.1161/CIRCULATIONAHA.117.032047
Years Gained: Healthy vs No Healthy Lifestyle

Y Li Circulation 2018 in press
DOI: 10.1161/CIRCULATIONAHA.117.032047
Years Gained: Moderate/Vigorous Activity
Does Lifestyle work in Real Life?
**Figure 1.** Age-adjusted mortality rates of coronary heart disease in North Karelia
USA Deaths from Cardiovascular Diseases
(1900-2010, Per 100,000 Population)

www.nhlbi.nih.gov/about/documents/factbook/2012/chapter4
Mortality Changes, N Karelia, 1970-2006

<table>
<thead>
<tr>
<th></th>
<th>1969-1971</th>
<th>2006</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>All causes</td>
<td>1,509</td>
<td>572</td>
<td>-62%</td>
</tr>
<tr>
<td>All cardiovascular</td>
<td>855</td>
<td>182</td>
<td>-79%</td>
</tr>
<tr>
<td>Coronary heart disease</td>
<td>672</td>
<td>103</td>
<td>-85%</td>
</tr>
<tr>
<td>All cancers</td>
<td>271</td>
<td>96</td>
<td>-65%</td>
</tr>
<tr>
<td>Lung cancers</td>
<td>147</td>
<td>30</td>
<td>-80%</td>
</tr>
</tbody>
</table>
Importance of Risk Factors In Heart Attacks
## Modifiable Risk Factors & MI in 52 Countries

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Cases (%)</th>
<th>Controls (%)</th>
<th>OR</th>
<th>PAR-2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smoking</td>
<td>48.1</td>
<td>65.2</td>
<td>2.0</td>
<td>36%</td>
</tr>
<tr>
<td>Diabetes</td>
<td>7.5</td>
<td>18.4</td>
<td>2.4</td>
<td>10%</td>
</tr>
<tr>
<td>Hypertension</td>
<td>21.9</td>
<td>39.0</td>
<td>1.9</td>
<td>18%</td>
</tr>
<tr>
<td>Obesity</td>
<td>33.3</td>
<td>46.3</td>
<td>1.6</td>
<td>20%</td>
</tr>
<tr>
<td>Psychosocial</td>
<td>-</td>
<td>-</td>
<td>2.7</td>
<td>32.5%</td>
</tr>
<tr>
<td>Vegetables/fruit</td>
<td>42.4</td>
<td>35.8</td>
<td>0.70</td>
<td>14%</td>
</tr>
<tr>
<td>Exercise</td>
<td>19.3</td>
<td>14.3</td>
<td>0.86</td>
<td>12%</td>
</tr>
<tr>
<td>EtOH intake</td>
<td>24.4</td>
<td>24.0</td>
<td>0.91</td>
<td>7%</td>
</tr>
<tr>
<td>ApoB/ApoA1</td>
<td>20.0</td>
<td>33-49</td>
<td>3.25</td>
<td>49%</td>
</tr>
<tr>
<td>All Risk Factors</td>
<td></td>
<td></td>
<td>129.2</td>
<td>90%</td>
</tr>
</tbody>
</table>

Cases = 15, 152  
Controls = 14,820  

Significant (P<0.05)  

Consider making into a histogram
Subhas Ganguli, 2017-04-28

What data collected on diet?
Subhas Ganguli, 2017-04-28
Relative Importance of Stress vs Diet
## Norway: Circulatory Disease Mortality

<table>
<thead>
<tr>
<th></th>
<th>1936-1937</th>
<th>1942-1945</th>
<th>Change (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Calories/day</td>
<td>3470</td>
<td>2850</td>
<td>- 18%</td>
</tr>
<tr>
<td>Fat (g/day)</td>
<td>159</td>
<td>71</td>
<td>- 55%</td>
</tr>
<tr>
<td>Protein (g/day)</td>
<td>115</td>
<td>93</td>
<td>- 19%</td>
</tr>
<tr>
<td>Carbohydrates (g/day)</td>
<td>395</td>
<td>429</td>
<td>+9%</td>
</tr>
</tbody>
</table>

Decreased: Meat, whole milk, cream, margarine, cheese, eggs, fruits, berries

Increased: Fish, skimmed milk, cereals, potatoes, vegetables

A Strom Lancet 1/20/1951:6647(257):126-129
Norway: Circulatory Disease Mortality

Decreased: Meat, milk, cream, margarine
Increased: Vegetables, fish, skimmed milk, cereals, potatoes

A Strom Lancet 1/20/1951:6647(257):126-129
The Role of Meat
Red Meat Consumption & Mortality

Prospectively followed 37,698 men (Health Professionals follow-up study, 1986-2008) & 83,644 women (Nurses Health Study 1980-2008) who were free of CV disease and cancer at baseline.

Diet assessed by validated questionnaire & updated every 4 years.

Documented 23,926 deaths (5910 CVD & 9464 cancer) during 2.96 million person-yrs of FU.

Multivariate adjustments for major lifestyle & dietary risk factors.
Red Meat Consumption & Mortality

Multivariate analysis to adjust for:

1) Intakes of: total energy, whole grains, fruits, vegetables (all in quintiles)
2) Age, BMI
3) Race (white, nonwhite)
4) Smoking status (never, past, current [3 ranges])
5) EtOH intake (0 plus 3 levels)
6) Physical activity (5 levels)
7) MVI use
8) ASA use
9) Family Hx: DM, MI, cancer
10) Baseline history of DM, Htn, hypercholesterolemia
11) Women: postmenopausal status, menopausal hormone use
Total Red Meat & Cardiovascular Mortality
Total meat intake by Quintile

<table>
<thead>
<tr>
<th></th>
<th>Q1</th>
<th>Q3</th>
<th>Q5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Men</td>
<td>0.25</td>
<td>0.95</td>
<td>2.07</td>
</tr>
<tr>
<td>Women</td>
<td>0.51</td>
<td>1.14</td>
<td>2.17</td>
</tr>
</tbody>
</table>

P < 0.001

A Pan Archives IM 2012 172(7):555-63
Total Red Meat & Total Mortality

Total meat outcome by Quintile

Increase in Hazard Ratio (%)

Men

<table>
<thead>
<tr>
<th></th>
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<th>Q3</th>
<th>Q5</th>
</tr>
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<td>0.51</td>
<td>1.14</td>
<td>2.17</td>
</tr>
</tbody>
</table>

Women

P < 0.001

Portions per day

A Pan Archives IM 2012 172(7):555-63
Meat Intake & All-Cause Mortality
Effect of replacing 1 portion red meat/day

Nuts for unprocessed red meat
Legumes for unprocessed red meat
Low-fat dairy for unprocessed red meat
Whole grains for unprocessed red meat
Poultry for unprocessed red meat
Fish for unprocessed red meat

Nuts for processed red meat
Legumes for processed red meat
Low-fat dairy for processed red meat
Whole grains for processed red meat
Poultry for processed red meat
Fish for processed red meat

Nuts for total red meat
Legumes for total red meat
Low-fat dairy for total red meat
Whole grains for total red meat
Poultry for total red meat
Fish for total red meat
Red Meat Consumption & Outcomes

Effect of a 1 serving per day increase

CVD = cardiovascular disease

P < 0.05
Seven cohorts: UK, Germany, California, USA, Netherlands, Japan
Total subjects = 124,706

**Significant reduction in:**
1) Ischemic heart disease mortality (29%, $p < 0.05$)
2) Cancer incidence (18%, $p < 0.05$)

**Non-significant reduction in:**
1) All cause mortality (9%, $p$=NS)
2) Circulatory disease mortality (16%, $p$=NS)
3) Cerebrovascular disease mortality (12%, $p$=NS)
How Much Fruit & Vegetables
Should I Eat?
Meta Cohort Studies: Fruit & Vegetables & Mortality Coronary Heart Disease

N = 15 studies, n = 17,742 cases, 775,132 participants

RR = 0.92 (0.90-0.94)
Meta Cohort Studies: Fruit & Vegetables & Mortality

All Cause Mortality

N = 15 studies, n= 71,160 cases, 959,083 participants

RR = 0.90 (0.87-0.93)

D Aune Int J Epidemiology 2017:1-28
Meta Cohort Studies: Fruit & Vegetables & Total Cancer

N = 12 studies

RR = 0.97 (0.95-0.99)
I2 = 49%

Fruits and vegetables and total cancer, nonlinear dose-response

<table>
<thead>
<tr>
<th>g/d</th>
<th>RR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>40</td>
<td>1.00</td>
</tr>
<tr>
<td>50</td>
<td>1.00 (0.99-1.00)</td>
</tr>
<tr>
<td>100</td>
<td>0.98 (0.97-0.98)</td>
</tr>
<tr>
<td>150</td>
<td>0.95 (0.94-0.97)</td>
</tr>
<tr>
<td>200</td>
<td>0.94 (0.92-0.95)</td>
</tr>
<tr>
<td>250</td>
<td>0.92 (0.90-0.94)</td>
</tr>
<tr>
<td>300</td>
<td>0.90 (0.88-0.93)</td>
</tr>
<tr>
<td>350</td>
<td>0.89 (0.86-0.92)</td>
</tr>
<tr>
<td>400</td>
<td>0.88 (0.85-0.91)</td>
</tr>
<tr>
<td>450</td>
<td>0.87 (0.85-0.90)</td>
</tr>
<tr>
<td>500</td>
<td>0.87 (0.84-0.90)</td>
</tr>
<tr>
<td>550</td>
<td>0.86 (0.84-0.89)</td>
</tr>
<tr>
<td>600</td>
<td>0.86 (0.84-0.89)</td>
</tr>
<tr>
<td>650</td>
<td>0.86 (0.84-0.89)</td>
</tr>
<tr>
<td>700</td>
<td>0.86 (0.84-0.88)</td>
</tr>
<tr>
<td>750</td>
<td>0.86 (0.84-0.88)</td>
</tr>
<tr>
<td>800</td>
<td>0.86 (0.84-0.88)</td>
</tr>
<tr>
<td>850</td>
<td>0.86 (0.84-0.88)</td>
</tr>
<tr>
<td>900</td>
<td>0.86 (0.84-0.88)</td>
</tr>
</tbody>
</table>

28338764
D Aune Int J Epidemiology 2017:1-28
<table>
<thead>
<tr>
<th>Condition</th>
<th>500 g/day</th>
<th>Deaths</th>
<th>800 g/day</th>
<th>Deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coronary Heart Disease</td>
<td>9.1%</td>
<td>4,832</td>
<td>16.9%</td>
<td>8,790</td>
</tr>
<tr>
<td>Stroke</td>
<td>23.2%</td>
<td>4,061</td>
<td>41.2%</td>
<td>7,215</td>
</tr>
<tr>
<td>Total Cancer</td>
<td>7.3%</td>
<td>5,785</td>
<td>8.5%</td>
<td>6,716</td>
</tr>
<tr>
<td>All-cause mortality</td>
<td>11.9%</td>
<td>32,326</td>
<td>16.9%</td>
<td>45,767</td>
</tr>
</tbody>
</table>
How Effective Are Dietary Interventions?
RCT Primary Prevention of Cardiovascular Disease with a Mediterranean Diet

Population: (n=7,447) Individuals 55-80 yrs (M 55-80, F 60-80) without CV disease at baseline and either NIDDM or 3 of: (smoking, Htn, inc LDL, low HDL, overweight/obese, FH premature CAD).

Intervention (1:1:1):
1) Advice to reduce dietary fat
2) Mediterranean diet + extra-virgin olive oil
3) Mediterranean diet + nuts (15 g walnuts, 7.5 g hazelnuts, 7.5g almonds)

Outcomes:
Primary: rate of major CV events (MI, CVA, death from CV causes). Occurred in 288 participants (3.8%) resulting in premature termination after median follow-up of 4.8 years.
Primary Prevention of CVD with a Mediterranean Diet: Primary End Point

Endpoint: Acute MI, CVA, death from CV

Estruch R NEJM 2013:368(14):1279-90
Comparison: Diet vs ASA vs Statin (Composite Cardiac Endpoint)

* P < 0.05 in original RCT

Estruch R NEJM 2013:368(14):1279-90
Arch IM 2012:172(3):209-216 (Meta)
Lyon Study: RCT Mediterranean Diet in Secondary Prevention

**Population:** 423 pts after first MI

**Design:** RCT of standard post-MI diet vs Mediterranean diet.
Followup: Mean 4 years.
ITT analysis

**Outcomes:**
- CO1: MI + cardiovascular death
- CO2: Same plus unstable angina, CHF, CVA, embolism (DVT, PE)
- CO3: CO2 plus minor events requiring hospitalization

Lancet 1994:343:1454-1459
Lyon Study
Nonfatal MI + CV Death (CO1)

ARR = 0.10
NNT = 10.0
P < 0.0001
Secondary Prevention of MI

Absolute Risk Reduction (%)

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Risk Reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lyon CO1</td>
<td>10.0</td>
</tr>
<tr>
<td>ASA</td>
<td>4.0</td>
</tr>
<tr>
<td>Beta B</td>
<td>2.0</td>
</tr>
<tr>
<td>Statin</td>
<td>3.0</td>
</tr>
</tbody>
</table>

Lancet 1994:343:1454-1459  
Circulation 2000:101:1206-18  
Arch Intern Med 2012:172(12):909-19
Role of a ‘Heart Healthy’ Diet
RCT Low Fat Diet + Risk of CVD
(Women’s Health Initiative)

Question: Would a dietary intervention intended to be low in fat & high in vegetables, fruits, and grains to reduce cancer also reduce CVD risk.


Intervention (40%): Intensive behavior modification in group and individual sessions designed to reduce total fat intake to 20% and increase intake of (vegetables + fruits) to 5 servings/day and grains to at least 6 servings/d.

- 18 group sessions in the first year and quarterly maintenance sessions thereafter.

Control: Received diet-related education materials.

Analysis: Intention to treat.

BV Howard JAMA 2006:295:655-666
## RCT Low Fat Diet + Risk of CVD

### Nutrient Intake at 6 yr

<table>
<thead>
<tr>
<th>Food</th>
<th>BL</th>
<th>Intervention</th>
<th>Control</th>
<th>Difference</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy kcal/d</td>
<td>1790</td>
<td>1432</td>
<td>1546</td>
<td>-114</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>Total fat (%)</td>
<td>37.8</td>
<td>28.8</td>
<td>37.0</td>
<td>-8.2</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>Saturated fat (%)</td>
<td>12.7</td>
<td>9.5</td>
<td>12.4</td>
<td>-2.9</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>Protein (%)</td>
<td>16.4</td>
<td>17.7</td>
<td>17.1</td>
<td>0.6</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>Carbohydrate (%)</td>
<td>45.6</td>
<td>53.9</td>
<td>45.9</td>
<td>8.1</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>Fiber g/d</td>
<td>15.4</td>
<td>16.9</td>
<td>14.4</td>
<td>2.4</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>Soluble fiber g/d</td>
<td>4.2</td>
<td>4.5</td>
<td>3.8</td>
<td>0.6</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>Folate ug/d</td>
<td>259</td>
<td>469</td>
<td>422</td>
<td>-50</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>Cholesterol mg/d</td>
<td>260</td>
<td>194</td>
<td>244</td>
<td>1.1</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>Veg + Fruit, servings/d</td>
<td>3.6</td>
<td>4.9</td>
<td>3.8</td>
<td>0.5</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>Grains, serv/d</td>
<td>4.7</td>
<td>4.3</td>
<td>3.8</td>
<td>0.2</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>Whole grain serv/d</td>
<td>1.1</td>
<td>1.2</td>
<td>1.0</td>
<td>-0.8</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>Nuts, serv/week</td>
<td>1.5</td>
<td>1.0</td>
<td>1.8</td>
<td>-0.8</td>
<td>&lt; 0.01</td>
</tr>
</tbody>
</table>

BV Howard JAMA 2006:295:655-666
<table>
<thead>
<tr>
<th></th>
<th>BL</th>
<th>Intervention</th>
<th>Control</th>
<th>Difference</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight, kg</td>
<td>76.8</td>
<td>-0.7</td>
<td>0.6</td>
<td>-1.3</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>BMI</td>
<td>29.1</td>
<td>-0.2</td>
<td>0.3</td>
<td>-0.5</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>Waist circumference, cm</td>
<td>89.0</td>
<td>-0.4</td>
<td>0.5</td>
<td>-1.0</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>Activity, METS/wk</td>
<td>10.0</td>
<td>1.4</td>
<td>1.0</td>
<td>0.4</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>SBP</td>
<td>127.7</td>
<td>-2.2</td>
<td>-2.1</td>
<td>-0.2</td>
<td>NS</td>
</tr>
<tr>
<td>DBP</td>
<td>76</td>
<td>-2.6</td>
<td>-2.3</td>
<td>-0.3</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>T-Cholesterol mg/dL</td>
<td>224.1</td>
<td>-10.2</td>
<td>-6.9</td>
<td>-3.3</td>
<td>&lt; 0.05</td>
</tr>
<tr>
<td>LDL mg/dL</td>
<td>133.7</td>
<td>-9.7</td>
<td>-6.2</td>
<td>-3.5</td>
<td>&lt; 0.05</td>
</tr>
<tr>
<td>HDL mg/dL</td>
<td>59.2</td>
<td>-0.7</td>
<td>-0.3</td>
<td>-0.4</td>
<td>NS</td>
</tr>
<tr>
<td>TG mg/dL</td>
<td>139.8</td>
<td>1.0</td>
<td>1.0</td>
<td>0.0</td>
<td>NS</td>
</tr>
<tr>
<td>Lipoprotein (a) mg/dL</td>
<td>15.6</td>
<td>0.9</td>
<td>0.9</td>
<td>0.0</td>
<td>NS</td>
</tr>
<tr>
<td>Glucose mg/dL</td>
<td>100.2</td>
<td>-1.7</td>
<td>-0.7</td>
<td>-1.0</td>
<td>NS</td>
</tr>
<tr>
<td>Total carotenoids mcg/mL</td>
<td>0.7</td>
<td>0.0</td>
<td>0.0</td>
<td>0.04</td>
<td>&lt; 0.05</td>
</tr>
</tbody>
</table>

RCT Low Fat Diet + Risk of CVD

Changes in Risk Factors at 3 yrs

SCG 2017

BV Howard JAMA 2006:295:655-666
RCT Low Fat Diet + Risk of CVD
Clinical Outcomes

BV Howard JAMA 2006:295:655-666
Women’s Health Initiative - Conclusions

1) In this study which resulted in an 8.2% decrease in total fat intake and an increase in daily (fruit + vegetable) intake of 1.1 servings/day there was no significant reduction in Cardiovascular disease or stroke overall.

2) Significant differences in CHD risk were seen in subgroups:
   a) Lowest levels of saturated fat intake (HR 0.81; P<0.05)
   b) Lowest intake of trans fat (HR 0.81; P<0.05)
   c) Highest intake of vegetables (HR 0.88; P<0.05)
Nutrient Profiles of Different Dietary Patterns Adventists Compared to WHI

- WHI: 16.9 g/day
- Non-Veg: 29.8 g/day
- Semi-Veg: 34.6 g/day
- Vegan: 46.4 g/day

BV Howard JAMA 2006:295:655-666
J Acad Nutrition & Dietetics 2013:113:1610-1619
Role of a Low Fat Vegetarian Diet In CAD
RCT Diet + Lifestyle in CAD

Aim: Assess effect of a comprehensive lifestyle intervention for 1 year in pts with atherosclerosis.

Patients: Angiographically documented CAD (1, 2 or 3 vessels)
- EF > 25%, no MI last 6 weeks

Randomised (n=28) (control = 20)
1) Low-fat vegetarian diet
2) Moderate aerobic exercise
3) Stress management training
4) Stopping smoking
5) Group support

Progression of CAD (195 lesions) assessed by blinded quantitative coronary angiography at baseline and after 1 year.

RCT Lifestyle in CAD: 5 Yr Results

RCT Lifestyle in CAD: Role of Adherence

SCG 2017

<table>
<thead>
<tr>
<th>Food</th>
<th>Baseline</th>
<th>1 Year</th>
<th>Change</th>
<th>% Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Triglycerides mg/dL</td>
<td>179.1</td>
<td>160.3</td>
<td>-18.8</td>
<td>-10.5</td>
</tr>
<tr>
<td>BMI</td>
<td>32.0</td>
<td>29.5</td>
<td>-2.5</td>
<td>-7.8</td>
</tr>
<tr>
<td>LDL mg/dL</td>
<td>107.9</td>
<td>99.8</td>
<td>-8.1</td>
<td>-7.5</td>
</tr>
<tr>
<td>HDL mg/dL</td>
<td>45.1</td>
<td>44.6</td>
<td>-0.5</td>
<td>-1.1</td>
</tr>
<tr>
<td>Systolic BP mmHg</td>
<td>132.7</td>
<td>126.4</td>
<td>-6.3</td>
<td>-4.7</td>
</tr>
<tr>
<td>Diastolic BP mmHg</td>
<td>79.0</td>
<td>75.2</td>
<td>-3.8</td>
<td>-4.8</td>
</tr>
<tr>
<td>Total cholesterol mg/dL</td>
<td>186.8</td>
<td>175.3</td>
<td>-11</td>
<td>-6.2</td>
</tr>
<tr>
<td>Dietary fat g/day</td>
<td>27.1</td>
<td>11.1</td>
<td>-16</td>
<td>-59.0</td>
</tr>
<tr>
<td>HbA1c %</td>
<td>7.3</td>
<td>6.89</td>
<td>-0.41</td>
<td>-5.6</td>
</tr>
<tr>
<td>Exercise min/wk</td>
<td>90.2</td>
<td>197.4</td>
<td>+107.2</td>
<td>228.8</td>
</tr>
<tr>
<td>Hostility (0 – 27)</td>
<td>7.8</td>
<td>6.0</td>
<td>-1.8</td>
<td>-23.1</td>
</tr>
<tr>
<td>Depression (0 – 60)</td>
<td>11.4</td>
<td>6.3</td>
<td>-5.1</td>
<td>-44.7</td>
</tr>
</tbody>
</table>

**Intensive Cardiac Rehab Program (at baseline and 1 year)**

P < 0.05

SCG 2017

Ornish Am J Health Promotion 2010:260-266
Role of a Low Fat Vegetarian Diet In Those At Risk
RCT plant based nutrition & body weight/CV risk (GEICO)

Aim: Assess effects of a low-fat, plant-based diet program on anthropometric & biochemical measures in a corporate setting.

Design: RCT, 10 sites, duration = 18 weeks

Population (n=291): 1) BMI > 25 +/- or 2) NIDDM - 83% female

Intervention:
1) Low-fat vegan diet, **weekly 1hr support group**, work cafeteria options available
2) Control group: No diet changes

SCG 2016

GEICO RCT: Outcomes – all participants

P < 0.001

Change (Pre-Post)

Weight (Kg)  BMI

Rx  Plc

P < 0.001

LU 6/15/15

GEICO RCT: Outcomes – all participants

- Total Chol: P < 0.001
- LDL Chol: P < 0.001
- HDL Chol: P < 0.001
- Triglycerides: P = 0.02

Levels:
- Positive change (Rx): -10 mg/dL to 15 mg/dL
- Negative change (Plc): -10 mg/dL to 15 mg/dL

GEICO RCT: Outcomes – all participants

Hemoglobin A1c

P = 0.004

GEICO: Discussion

1) Saw statistically and clinically relevant changes body weight, lipids, and glycemic control among diabetics in a workplace-based nutrition program.

2) Weight changes were similar to those seen in plant-based diets in observational or research settings.

3) The changes seen in lipids are typically more than those seen with more moderate diets. Other studies have shown that the decreases in HDL seen are not associated with poor cardiovascular health.

4) Strengths: geographically diverse population; used a simple & reproducible intervention; sufficient statistical power to show changes.

5) Weaknesses: underrepresentation of males; lack of data on physical activity.
Possible Mechanism of Action
Endothelial Function after a High Fat Meal

**Diagram:**
- **Y-axis:** Flow-mediated vasoreactivity (percent change in diameter)
- **X-axis:** Hours (baseline, 1, 2, 3, 4, 5, 6)
- **Legend:**
  - HIGH FAT
  - LOW FAT

**Graph Analysis:**
- There is a significant decrease in flow-mediated vasoreactivity for both groups after a high fat meal.
- The decrease is more pronounced for the HIGH FAT group compared to the LOW FAT group.
- Statistical significance is indicated by an asterisk (* P < 0.05) at the 3-hour mark for both groups.

**Supplemental Image:**
- Ultrasound
- Cuff
<table>
<thead>
<tr>
<th></th>
<th>Then</th>
<th>Now</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Breakfast</strong></td>
<td>Bran flakes + granola + milk</td>
<td>Oats + Chia + blueberries + flax</td>
</tr>
<tr>
<td><strong>Lunch</strong></td>
<td>Sandwich +/- veggies + diet</td>
<td>Kale salad + nuts</td>
</tr>
<tr>
<td></td>
<td>coke</td>
<td></td>
</tr>
<tr>
<td><strong>Suppers</strong></td>
<td>Spaghetti Bolognese +/- salad</td>
<td>Veggie stir fry (Mediterranean,</td>
</tr>
<tr>
<td></td>
<td>Chicken curry, rice, dal</td>
<td>Asian, Indian) w garlic/ginger</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Rice/quinoa, dal/beans</td>
</tr>
</tbody>
</table>

Exercise: Minimal => 2-3 hrs per week
Welcome to ‘Food as Prevention’

Welcome to the Food as Prevention website!

This website is maintained by a Canadian physician who is a gastroenterologist (specialist in diseases of the intestines) with the aim of connecting members of the public with information on a healthier diet to lower mortality and the risk of developing diseases such as heart attacks, strokes, adult-onset (type 2) diabetes, and cancer.

I have a masters degree in health research methodology and have tried to make the information in this site as evidence-based as possible. Fortunately, the peer-reviewed medical literature has a lot of information on the role of food in preventing disease.

The site is divided into an ‘evidence’ section that guides you through evidence about the healthiest diet and an ‘application’ section to help you make changes to your diet and lifestyle.

This site is aimed at several audiences:

1. Members of the general public who are looking for credible information on the healthiest diet.

SCG 2012
MICHAEL GREGER, M.D.
DAILY DOZEN

1. BEANS
2. BERRIES
3. OTHER FRUITS
4. CRUCIFEROUS VEGETABLES
5. GREENS
6. OTHER VEGETABLES
7. FLAXSEEDS
8. NUTS
9. SPICES
10. WHOLE GRAINS
11. BEVERAGES
12. EXERCISE

Questions