Optimize Your Diet

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10-Year Coronary Incidence Per 10,000 Men

(y = 77 + 78x, r = 0.73)

Incidence

% Diet Calories from Saturated Fat

Keys 1980
Mensink and Katan, 1987
Effect of Trans and Saturated Fat (10% E) on Blood Lipids (vs Monounsaturated Fat)  
(*Mensink & Katan, 1990*)

<table>
<thead>
<tr>
<th></th>
<th>Trans fat</th>
<th>Saturated fat</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total cholesterol</td>
<td>+6%</td>
<td>+12%</td>
</tr>
<tr>
<td>LDL cholesterol</td>
<td>+14%</td>
<td>+18%</td>
</tr>
<tr>
<td>HDL cholesterol</td>
<td>-12%</td>
<td>0%</td>
</tr>
<tr>
<td>LDL/HDL ratio</td>
<td>+29%</td>
<td>+18%</td>
</tr>
</tbody>
</table>
Nurses’ Health Study (n=121,700)


Ocs
Smoking
Weight/Ht
Med. Hist.

Diet Nails Diet Diet Diet Diet Diet Diet Diet Diet Diet Diet Diet

Health Professionals Follow-up Study (n=52,000)


Diet Nails Diet Diet Blood Diet Diet Diet

Nurses’ Health Study II (n=116,000)

1989 1991 1993 1995 1997 1999 2001 2003 2005 2007 2009

Diet Diet Blood Diet Diet Diet Diet Diet Diet


0.198a
Type of Dietary Fat and Risk of Coronary Heart Disease
The Nurses' Health Study
14-Year Follow-up

% Change in CHD

Trans

Sat

Mono

Poly

Low Fat Diet and Cardiovascular Disease—WHI

HR = 0.97 (95% CI = 0.90, 1.06)

(Howard et al. 2006)
Kaplan-Meier Estimates of the Incidence of Outcome Events in the Total Predimed Study Population

(Estruch R et al. NEJM 2013)
Conclusions

1. CHD rates can be dramatically reduced by nutritional means, but this will not be achieved by replacing saturated fat with carbohydrate.

2. We should abandon recommendations regarding % of energy from fat and avoid pejorative references to fat or “fatty foods”.

3. Advice about dietary fat should focus on replacement of saturated and trans fat with vegetable oil, including sources of N-3 fatty acids.
FDA moves to ban trans fat as threat to health

BY DEBORAH KOTZ
GLOBE STAFF NOVEMBER 08, 2013

WASHINGTON — Heart-damaging trans fat may soon vanish completely from supermarket products such as microwave popcorn, pie crusts, frosting, and biscuit dough after the Food and Drug Administration on Thursday proposed **banning the artificially manufactured fat from the food supply.**
Randomized trial of dietary intervention for breast cancer prevention

Cohort analysis

All invasive breast cancer

\[ HR^* = 1.19 \text{ (95\% CI\#: 0.91–1.55)} \]

(Martin LJ, et al. 2011)
Fat & Postmenopausal Breast Cancer in NHS, 1980-2000 (3537 cases)

RR of Breast Cancer vs. Cumulative Average Fat Intake (%E)

*P, trend test 0.11*

(Kim et al. 2006)
BMI and Mortality

(Whitlock & Peto 2009)
PoundsLost: Primary Trial Outcome, 2 years
Body Weight Change: All randomized participants

26.112

Changes in Food and Beverage Consumption and Weight Changes Every 4 Years According to Study Cohort

(Mozaffarian D et al., NEJM 2011)
Superiority of Mediterranean and Low-Carb compared to Low-fat: A 6-Year Follow-up

(Schwarzfuchs et al. NEJM Oct 3, 2012)
Estimated Sources of Calories in US Diet

- Refined grain
- Added sugar
- Protein
- Mono fat
- Poly fat
- Sat fat
- Other carbs
- Whole grain
- Potatoes
- Trans fat

(unpublished, compiled from NHANES)
Substitution of Protein Sources (1 sv/day) and Risk of CHD in NHS, 1980-2006 (3162 cases) (Bernstein et al. 2010)
Relative Risk of type 2 diabetes for replacing 1 serving/day of total red meat with other foods. Data from NHS, NHSII, HPFS, including 13,759 cases of diabetes (Pan A et al. AJCN, 2011)
Total Mortality According to Frequency of Nut Consumption

3,038,853 person-years
16,200 women (NHS) and 11,229 men (HPFS) died

$P, \text{ trend } = <0.001$

(Bao et al., NEJM 2013)
Estimated GHG Emissions per Calorie
(Derived from Clean Metrics / Environmental Working Group, Meat Eaters Guide Methodology, 2011)

<table>
<thead>
<tr>
<th>Food Product</th>
<th>GHG/Calorie</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lamb</td>
<td>14.004</td>
</tr>
<tr>
<td>Beef</td>
<td>10.112</td>
</tr>
<tr>
<td>Salmon</td>
<td>7.123</td>
</tr>
<tr>
<td>Pork</td>
<td>4.345</td>
</tr>
<tr>
<td>Milk (2%)</td>
<td>3.123</td>
</tr>
<tr>
<td>Cheese</td>
<td>2.312</td>
</tr>
<tr>
<td>Eggs</td>
<td>1.987</td>
</tr>
<tr>
<td>Chicken</td>
<td>1.765</td>
</tr>
<tr>
<td>Tofu</td>
<td>1.543</td>
</tr>
<tr>
<td>Dry beans</td>
<td>1.321</td>
</tr>
<tr>
<td>Lentils</td>
<td>1.100</td>
</tr>
</tbody>
</table>
Cancer
P-value, test for trend=0.88

Cardiovascular Disease
P-value, test for trend=0.0003

(Hung et al. 2004)
Fruit and Vegetable Intake and Risk of Breast Cancer by Hormone Receptor Status

(N=993,466 women in 20 cohorts; 19,869 ER+ cancers and 4821 ER- cancers)

p=0.91
p=0.03

(Seungyoun J et al., JNCI 2013)
Relative Risk of Type 2 Diabetes for Substitution of Specific Fruits (3 servings/ week) for Fruit Juice

(Muraki I. et al, BMJ 2013)
Summary of Fruits and Vegetables

1. High intake of fruits and vegetables during adult life is likely to at most have a modest impact on overall cancer risk.

2. High intake of fruits and vegetables will reduce risks of cardiovascular disease, in part due to higher potassium intake, and probably higher intake of folate.
DIAGRAM OF A WHOLE GRAIN

Bran

Endosperm

Germ

Grain Anatomy

Courtesy of Bob’s Red Mill
<table>
<thead>
<tr>
<th>Cereal Fiber, Energy-Adjusted, g/day</th>
<th>Women (591 cases)</th>
<th>Men (734 cases)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>RR of CHD</td>
<td>RR of CHD</td>
</tr>
<tr>
<td>2.2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>3.1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>3.8</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>4.9</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>7.7</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

*(Wolk et al. 1999) (Rimm et al. 1996)*
Milling of Grains

Whole Grain

- Bran
- Endosperm
- Germ

Refined Grain

- Endosperm

Source: General Mills
Blood Glucose
Insulin
Easily Digested Carbohydrate

Blood Glucose
Insulin
Slowly Digested Carbohydrate

Time (hr)
Relative Risk of NIDDM by Different Levels of Cereal Fiber and Glycemic Load

(Salmeron et al, 1997)
Relative Risk of Coronary Heart Disease

Body Mass Index (kg/M²)

Relative Risk of Coronary Heart Disease

Glycemic Load

Tertile 3 (highest)
Tertile 2
Tertile 1 (lowest)

Tertile 1 (lowest)
Tertile 2
Tertile 3 (highest)

Liu et al., 2000
Sugar-Sweetened Beverage Consumption

- Energy in liquid form
- Displacement of more satiating foods
- High glycemic load
- Fructose
- Alteration of taste preferences

Increased intake of sugary foods; decreased intake of vegetables, fruits, etc

Increased intake of fiber micronutrients, antioxidants and other phytochemicals

Increased energy intake

Passive calorie overconsumption when drinking to satisfy thirst

Increased hunger

Postprandial hyperglycemia & hyperinsulinemia

Insulin resistance

B-cell dysfunction

Metabolic Syndrome (low HDLC, high triglyceride, hypertension, hyperglycemia coagulopathy, chronic inflammation)

Obesity

Diabetes

CHD

Gout

Dental caries

Hyperuricemia

(Ludwig & Willett, 2010)
Regular Soft Drinks and Type 2 Diabetes, NHS2

Sugar-sweetened soft drink consumption

P < 0.001 for trend

(Schulze et al. 2004 JAMA)
Sugar-sweetened beverage consumption and risk of T2DM, per increase in one 12 oz serving of SSB per day (random-effects estimate)
Summary of Carbohydrates

1. Like dietary fat, carbohydrate quality rather than the percent of calories from carbohydrate appears to be important for health.

2. Consuming grains in the form of high-fiber, whole grains will reduce risks of type 2 diabetes and coronary heart disease, but high intake of refined grains is likely to increase risks of these diseases.

3. High intake of refined starch and sugar is particularly problematic with underlying insulin resistance.

4. Reduction of soda and other sugary beverages is a high priority.
Available calcium in the food supply compared to the incidence of hip fractures in females of several nations

(Hegsted, 1986)
Pooled Analysis of Categories of Milk Intake* & Hip Fractures in Women (All Studies)

*The reference categories in different studies ranged from rarely/never to 1 glass/day

(Bischoff-Ferrari et al.)
Pooled Analysis of Hip Fracture Risk & Total Calcium Intake for Women*

* The reference categories in different studies ranged from 210-420 mg/day of total calcium intake

(Bischoff-Ferrari et al.)
RR of hip fractures by frequency of milk consumption during teenage years among men aged 50+ years in HPFS and among postmenopausal women in NHS

Relative Risks

(Feskanich D et al., JAMA Pediatrics 2013)
Calcium Intake & Risk of Prostate Cancer, 1986-2002

(Giovannucci et al. 2006)

Relative Risk vs. Calcium Intake (mg/day)

- Fatal (p=0.01)
- Non-advanced (p=0.55)
## NAS/IOM Criteria and Dietary Reference Intake Values for Calcium by Life-Stage Group

<table>
<thead>
<tr>
<th>Life-Stage Group (a)</th>
<th>Criterion</th>
<th>Al (mg/day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 to 6 months</td>
<td>Human milk content</td>
<td>210</td>
</tr>
<tr>
<td>6 to 12 months</td>
<td>Human milk + solid food</td>
<td>270</td>
</tr>
<tr>
<td>1 through 3 years</td>
<td>Extrapolation of maximal calcium retention from 4 through 8 years</td>
<td>500</td>
</tr>
<tr>
<td>4 through 8 years</td>
<td>Maximal calcium retention</td>
<td>800</td>
</tr>
<tr>
<td>9 through 13 years</td>
<td>Maximal calcium retention</td>
<td>1,300</td>
</tr>
<tr>
<td>14 through 18 years</td>
<td>Maximal calcium retention</td>
<td>1,300</td>
</tr>
<tr>
<td>19 through 30 years</td>
<td>Maximal calcium retention</td>
<td>1,000</td>
</tr>
<tr>
<td>31 through 50 years</td>
<td>Calcium balance</td>
<td>1,000</td>
</tr>
<tr>
<td>51 through 70 years</td>
<td>Maximal calcium retention</td>
<td>1,200</td>
</tr>
<tr>
<td>&gt; 70 years</td>
<td>Extrapolation of maximal calcium retention from 51 through 70 years</td>
<td>1,200</td>
</tr>
</tbody>
</table>

**Pregnancy**

<table>
<thead>
<tr>
<th></th>
<th>Bone mineral mass</th>
<th>Al (mg/day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;19 years</td>
<td></td>
<td>1,300</td>
</tr>
<tr>
<td>19 through 50 years</td>
<td></td>
<td>1,000</td>
</tr>
</tbody>
</table>

**Lactation**

<table>
<thead>
<tr>
<th></th>
<th>Bone mineral mass</th>
<th>Al (mg/day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;19 years</td>
<td></td>
<td>1,300</td>
</tr>
<tr>
<td>19 through 50 years</td>
<td></td>
<td>1,000</td>
</tr>
</tbody>
</table>
## UK Dietary Reference Values for Calcium (mg/d)

<table>
<thead>
<tr>
<th>Population Groups</th>
<th>0-12 months</th>
<th>1-3 years</th>
<th>4-6 years</th>
<th>7-10 years</th>
<th>11-18 yrs M/F</th>
<th>19+ yrs</th>
<th>Lactation</th>
</tr>
</thead>
<tbody>
<tr>
<td>RNI</td>
<td>525</td>
<td>350</td>
<td>450</td>
<td>550</td>
<td>1000/800</td>
<td>700</td>
<td>+550</td>
</tr>
</tbody>
</table>

Dept. of Health (UK), Nutrition and Bone Health, 1998
WHO Adequate Calcium Intake

500 mg per day is adequate for preventing fractures in countries with high fracture rates. (lower amounts appear adequate for countries with low fracture rates)

Folate, Alcohol & Myocardial Infarction
(NHS 1980-1994)

(Rimm E, et al JAMA 1998)
Cumulative Alcohol Consumption & Risk of Breast Cancer in the NHS, 1980-2004

(P for trend, <0.0001)

(Chen WY et al. JAMA 2011)
Attributable Risk of Coronary Heart Disease Due to Modifiable Diet and Lifestyle Risk Factors in the NHS (1980 to 1994)

Low Risk:

1. Non smoker
2. BMI < 25 kg/m²
3. Exercise $\geq \frac{1}{2}$ hr of brisk walking/day
4. Good diet (upper 2 quartiles of score based on low trans fat, high p/s ratio, low glycemic load, high cereal fiber, high fish, high total folate)
5. Alcohol 5+g/day

- Proportion at low risk = 3.1%
- Population Attributable Risk = 82% (95% CI = 58-93%)

Stampfer et al, 2000
Percentage of Type 2 Diabetes Potentially Preventable by Simultaneous Reduction of Five Modifiable Risk Factors (NHS)

**Low Risk**

1. Nonsmoking
2. BMI < 25
3. Moderate to vigorous exercise
4. Diet score in upper 40% (low trans fat, high cereal fiber, low glycemic load, high P:S ratio)
5. Alcohol 5+ grams/day

Percent in low risk group: 4.1%
Population attributable risk (PAR): 92% (82-96)

*(Hu F et al., NEJM 2001)*
Proportion of Colon Cancers that are Potentially Preventable by Simultaneous Reduction of 6 Modifiable Risk Factors (HPFS) 

(Platz et al. 2000)

**Low Risk**

1. BMI $\leq 25$ kg/m$^2$
2. Physical activity $\leq 30$ min/day of vigorous – moderate activity
3. Alcohol $< 15$ g/day or 15-30 g/day with supplemental folic acid
4. Folic acid supplement of $\geq 100$ µg/day
5. $\leq 3$ pack – years of smoking
6. Red meat $\leq 2$ servings/week

*Joint low risk group* = 3.1% of population

*Population attributable risk (PAR):* 71% (33-92)
Lowfat products whenever possible; calcium supplements are an effective substitute for preventing fractures.

Importance is well-documented; greens and dark orange vegetables should be included. Even more frequent servings may be desirable.

Whole-grain, minimally processed products should be emphasized.


Misleading as 2-3 servings of meat/day is probably unhealthy.

Support for generous intake is well documented.
HEALTHY EATING PLATE

Use healthy oils (like olive and canola oil) for cooking, on salad, and at the table. Limit butter. Avoid trans fat.

The more veggies—and the greater the variety—the better. Potatoes and french fries don’t count.

Eat plenty of fruits of all colors.

Drink water, tea, or coffee (with little or no sugar). Limit milk/dairy (1-2 servings/day) and juice (1 small glass/day). Avoid sugary drinks.

Eat whole grains (like brown rice, whole-wheat bread, and whole-grain pasta). Limit refined grains (like white rice and white bread).

Choose fish, poultry, beans, and nuts; limit red meat; avoid bacon, cold cuts, and other processed meats.

STAY ACTIVE!

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The Nutrition Source
www.hsph.harvard.edu/nutritionsource

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Total dietary quality score measured by the AHEI-2010 among participants aged 20 years or older with different genders by NHANES study period

(Wang D et al., unpublished data)