Calming Cardiovascular Inflammation with DIET

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Take Home Message

- Inflammation is present in CVD & most other chronic diseases
- The diet for cardiovascular disease is no longer the “low cholesterol low fat diet”
- Foods can have pro & anti-inflammatory effects
- The phytonutrients and synergy in whole foods are magic.
- Food talks to genes
- Limit pro-inflammatory foods and maximize anti-inflammatory foods
Norm’s Stats
New Type 2 DM
10/19/2007

- A1C=10.0%
- FBG=255 mg/dl
- ↑ LFT’s
- BP 177/92
- Weight=352#

Norm Refused all medications!

CVD & Diabetes
An Inflammatory Diseases

- ↑ inflammation in endothelial wall
- ↑ inflammation markers—CRP, adhesion molecules, cytokines, WBC—interleukin-6, tumor necrosis factor, interferon gamma, monocyte chemoattractant protein, nuclear factor kappa B, Cd 40, lipoprotein-associated phospholipase A2, myeloperoxidase, introtyrosine, matrix metalloproteinase-9 . . .the list grows longer weekly . . .
Norm’s Stats—**3 weeks later**

- **10/19/2007**
  - A1C=10.0
  - FBG=25 5
  - ↑ LFT’s
  - BP 177/92
  - Weight=352#

- **11/8/2007**
  - FBG=120
  - BP 140/80
  - Weight=340#

Norm’s Diet:

*“Cut out Processed Foods . . . Eat Real Foods!”*

**Breakfast**
- Chopped Fruit/Nuts
- Oatmeal
- 1/4c. Ground flax seeds
- Whole wheat toast
- 1/4 grapefruit
- 1 date
- 6 oz. v-8 juice

**Lunch**
- Salad or soup with veges, dry beans, barley, salmon occasionally
- olive oil & vinegar on salad

**Dinner**
- Veges, beans
- PB & WW crackers salmon

**Snacks:** Snap peas, few nuts, veges

**Norm choose to eliminate:** Meats, poultry, bread, cold cereal, rice, pasta, potatoes, sweets, juices, fried foods, white flour foods
Norm’s Stats—3 months later

- 10/19/2007
  - A1C=10.0
  - FBG=255
  - ↑ LFT's
  - BP 177/92
  - Weight=352#

- 1/16/2008
  - A1C=6.5
  - FBG=115
  - Normal LFT's
  - BP 140/80
  - Weight=314#
    - (38# loss/12 weeks)

  - FBG=120
  - BP 140/80
  - Weight=340#

CVD Diet Shifts

- Diet & cholesterol
- Diet & inflammation
Low-Grade Systemic Inflammation

- Why the low grade inflammation?
- What does abdominal obesity have to do with inflammation?
- How does it promote disease?
- Can diet promote or prevent this inflammation?

Immune Response: Inflammation Team

- WHO is calling for the Inflammation Team?
  - Chronic Stress (Current Lifestyle)
  - Injured Tissues (What is causing injury?)
  - Adipocytes (Hypertrophy)
  - Food/Diet

O’Keefe J. JACC 2008;51(3):249-55
Giugliano D. JACC 2006;48(4):677-685
Mathieu P. Hypertension 2009;53:577-84
• Abdominal Adipocyte
  Not just about fat storage . . . an endocrine organ.

• Close ties between metabolic & immune systems

Wellen KD. J Clin Invest 2005;115:111-1119

Malnutrition / Energy Deficit
  Immuno-suppression, Susceptibility to infection

Optimal Nutrition
  Normal immune function

Starvation

Over nutrition / Long term Energy Surplus
  Immuno-activation, Susceptibility to inflammatory disease

Obesity

Wellen KD. J Clin Invest 2005;115:111-1119
Abdominal Obesity

Releasing Free Fatty Acids

Secreting pro-inflammatory chemokines:
Tumor Necrosis Factor (TNF)
Interleukin-6 (IL-6)

Consequences of elevated free fatty acids (FFA)

Endothelial Dysfunction

Insulin Resistance

Type 2 Diabetes

NAFLD

Visceral Fat

Consequences of elevated free fatty acids (FFA)

**Consequences of elevated pro-inflammatory cytokines**


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**Low-Grade Systemic Inflammation**

Diet

Genetics

Prenatal Exposure

Activity/Lifestyle
Diet & CV Inflammation

Pro-inflammatory Foods
- ↑ Inflammatory triggers—TNF, IL-6
- ↑ Free Radicals/Oxidative stress
- ↑ Lipidemia (TG, VLDL)
- ↑ Free fatty acids
- ↑ Glucose

Endothelial Dysfunction
- ↑ Insulin Resistance

Anti-inflammatory Foods
- ↓ Inflammatory triggers—TNF, IL-6
- ↓ Free Radicals/Oxidative stress
- ↓ Lipidemia (TG, VLDL)
- ↓ Free fatty acids
- ↓ Glucose

Endothelial Dysfunction
- ↓ Insulin Resistance

1. “Damaged fats”
2. Fructose (sucrose/HFCS)
3. Glycemic index CHO

Post-prandial Dysmetabolism

Giugliano D. JACC2006;48:677-85
Ceriello A. Circulation 2002;106:1211-1215
Diet & CV Inflammation

- Pro-inflammatory Foods
  - Inflammatory triggers—TNF, IL-6
  - Free Radicals/Oxidative stress
  - Lipidemia (TG, VLDL)
  - ▲ Free fatty acids
  - ▲ Glucose

Post-prandial Dysmetabolism

1. “Damaged fats”
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Giugliano D. JACC 2006;48:677-85
Ceriello A. Circulation 2002;106:1211-1215

ROS
Reactive oxygen species
Free Radicals
Oxidation
Oxidative Stress
Anti-oxidants
Oxidized Cholesterol
Oxidized Fatty Acids
Lipid Peroxides
Free Radical Actions

- Damage or destroy cells
- Damaged cells are more vulnerable to disease
- Damaged cells cause inflammation
- Associated with premature aging

Diet & CV Inflammation

- Pro-inflammatory Foods
  - ↑ Inflammatory triggers—TNF, IL-6
  - ↑ Free Radicals/Oxidative stress
  - ↑ Lipidemia (TG, VLDL)
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1. “Damaged fats”
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Post-prandial Dysmetabolism

Giugliano D. JACC 2006;48:677-85
Ceriello A. Circulation 2002;106:1211-1215
“Damaged Fats” & Inflammation

- High heat Grilling/Broiling
  - “Advanced Glycation End Products”
  - Free Radicals
- Frying
  - Trans Fats
  - Free Radicals
- Refining
  - Trans Fats
  - Free Radicals
- Hydrogenation
  - Trans fats

**

- “Influence on human health of fats altered by high heat cooking is just emerging.”

- “...strong relationship between fat and heart disease may be due to the presence of oxidized fats and oils in Western diets.”

Birlouez-Aragon I. AmJClinNutr2010;91;1220-6
Fructose & Inflammation

- Cells use glucose as an energy source
- Fructose is immediately metabolized in liver to Free Fatty Acids
- Increase abdominal adiposity

Liu H. CancerRes2010;70(15):6368-76
Stanhope

Main Sources of Fructose

<table>
<thead>
<tr>
<th></th>
<th>High Fructose Corn Syrup</th>
<th>Sucrose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fructose</td>
<td>42-50%</td>
<td>50%</td>
</tr>
<tr>
<td>Glucose</td>
<td>50-53%</td>
<td>50%</td>
</tr>
</tbody>
</table>
High Glycemic CHO & Inflammation

- Rapid rise in postprandial blood glucose increase inflammatory mediators
- High glycemic CHO:
  - Foods made from flour, rice, potatoes

Buyken A. AmJClinNutr2010; doi: 10.3945/ajcn.2010.29390

Diet & CV Inflammation

- **Pro-inflammatory Foods**
  - ↑ Inflammatory triggers—TNF, IL-6
  - ↑ Free Radicals/Oxidative stress
  - ↑ Lipidemia (TG, VLDL)
  - ↑ Free fatty acids
  - ↑ Glucose

- **Anti-inflammatory Foods**
  - ↓ Inflammatory triggers—TNF, IL-6
  - ↓ Free Radicals/Oxidative stress
  - ↓ Lipidemia (TG, VLDL)
  - ↓ Free fatty acids
  - ↓ Glucose

1. “Damaged fats”
2. Fructose (sucrose/HFCS)
3. ↑ Glycemic index CHO

Giugliano D. JACC2006;48:677-85
Whole Foods & Healthy Fats

- Loaded with phytonutrients
- Nutrients act synergistically
- Healthy Fats
  - Omega 3 fatty acids
  - Nuts
  - Extra Virgin Olive

Food Synergy
Phytonutrients
Whole Foods
Some of the “Team” in Thyme

- Alanine
- Anethole essential oil
- Apigenin
- Ascorbic acid
- Beta-carotene
- Caffeic acid
- Camphene
- Carvacrol
- Chlorogenic acid
- Chrysoeriol
- Derulic acid
- Eriodictyol
- Eugenol
- 4-terpinol
- Gallic acid
- Gamma-terpinene
- Isichologenic acid
- Isoeugenol
- Isothymomonin
- Kaemferol
- Labiatic acid
- Lauric acid
- Linalyl acetate
- Luteolin
- Methionine
- Myrcene
- Myristic acid
- Naringenin
- Rosmarinic acid
- Selenium
- Tannin
- Thymol
- Trtophan
- Ursolic acid
- Vanillic acid

Real Food: Whole Foods**
“Bioactive Compounds”
Phytonutrients in Foods: 8000+ identified

- **Soluble dietary fibers (APPLES)**
  - B-Glucan, pectin

- **Organosulfur Compounds (GARLIC, ONIONS)**
  - Allicin, diallyl sulfide

- **Phytoestrogens (SOY)**
  - Lignins
    - Enterodiol, coumestrol
  - Isoflavones
    - Genistein, daidzein
  - Resveratrol (GRAPES)
  - Lycopene (TOMATOES)

- **Phenolic Acids (CINNAMON)**
  - Hydroxy-cinnamic acids
    - Caffeic, ferulic, sinapic

- **Flavonoids (CHOCOLATE)**
  - Flavanols
    - Catechin, epicatechin, gallate
  - Flavonols
    - Quercetin, catechin, epicatechin, epigallocatechin

- **Monoterpenes (ORANGES)**
  - D-Limonene, perillic acid

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**Taking Nutrients out of Context (FOOD & DIET)**

“Evidence is mounting that foods and food patterns act synergistically to reduce the risk of chronic diseases.”

**Food synergy** = additive influences of combined nutrients in a food or combined foods in a meal

Jacobs, D. AmJClinNutr 2003;78(suppl):508S-13S
Whole Wheat Food Synergy

“Benefits accrue when all edible parts of the grain are included (bran, germ and endosperm). It appears that phytochemicals that are located in the fiber matrix, in addition to or instead of the fiber itself, are responsible for the reduced risk of disease.”

Jacobs, D. AmJClinNutr 2003;78(suppl):508S-13S

Anti-oxidant Activity of an Apple

apple = 6 mg, vitamin C

“Anti-oxidant activity” of apple = 1500 mg “vitamin C equivalents”

Most of the anti-oxidant activity comes from the natural combination of phytochemicals

NOT vitamin C

Eberhart M. Nature 2000;405:903-4
The Mediterranean Secret (before 1960) = Healthy Fats & Whole Foods

- Abundant plant foods (7 servings/day fruits & vege (esp. wild greens), seasonings, beans, nuts, seeds)
- Minimally processed foods (seasonally fresh & locally grown)
- Fresh fruits for dessert -- sweets rarely
- Extra Virgin Olive oil
- Dairy products (mainly cheese and yogurt— from grass fed animals)
- Red meat infrequently, mostly fish & poultry
- Wine at meals
- n-3 at each meal (salmon, herring, mackerel, walnuts, flaxseeds, green leafy vegetables)

2006 Analysis of Mediterranean Studies (43 articles)

- Lyon Heart Study ↓ 70% cardiac death & MI
- Indo Mediterranean Heart Study (1000 subjects)
  - ↓ 67% cardiac death
  - ↓ 48% all cardiac end points
- Gissi Prevention Trial (11,323 subjects)
  - ↓ 51% cardiac death
- Esposito-- Metabolic Syndrome (180 subjects)
  - ↓ inflammation markers
  - ↓ 60% metabolic syndrome

Serra-Majem L. Nutr Rev 2006;64(2)s27-s47
Prospective Swedish Study
60,000 women followed x 10yrs

- Consuming 16-17 healthy foods ↓42% all-cause mortality compared to 0-8 healthy foods

- For each additional healthy food consumed the risk of death was 5% lower

Michels K. IntlJEpidem 2002;31:847-854
1,2-Vinylidithiin from Garlic Inhibits Differentiation and Inflammation of Human Preadipocytes

Mayoura Keophiphith, Fabian Priem, Ingrid Jacquet-Mond-Collet, Karine Clément, and Danièle Lacasa

Abstract
Obesity is a state of chronic low-grade inflammation. Limiting white adipose tissue (WAT) expansion and therefore reducing inflammation could be effective in preventing the progression of obesity and the development of associated complications. We investigated the effects of 1,2-vinylidithiin (1,2-DT), a garlic-derived organosulfur, on the differentiation and inflammatory state of human preadipocytes. Preadipocytes were prepared from subcutaneous adipose tissue of nonobese young women and differentiated in the presence of 1,2-DT. Inflammatory preadipocytes were obtained following treatment with human macrophage-secreted factors. 1,2-DT (100 μM) significantly reduced gene expression of PPARγ, NNAL, TNFα, ICAM1, and IL1β.

Grapes and Cardiovascular Disease

Mustali M. Dohadwala and Joseph A. Vita

Abstract
Epidemiological studies suggest that consumption of wine, grape products, and other foods containing polyphenols is associated with decreased risk for cardiovascular disease. The benefits of wine consumption appear to be greater than that of other alcoholic beverages. Experimental studies indicate that grape polyphenols could reduce atherogenesis by a number of mechanisms, including inhibition of oxidation of LDL, and other favorable effects on cellular redox status, improvement of endothelial function, lowering blood pressure, inhibition of platelet aggregation, reducing inflammation, and activating novel proteins that prevent cell senescence, e.g., Sirtuin 1. Translational studies in humans support these beneficial effects. More clinical studies are needed to confirm these effects and formulate dietary guidelines. The available data, however, strongly support the recommendation that a diet rich in fruits and vegetables, including grapes, can decrease the risk for cardiovascular disease.

Introduction
The medicinal value of the grapevine and its fruit, Vitis vinifera, has been recognized for over 6000 y (1). In ancient Egypt, wine from grapevines was made into an ointment to treat skin and eye conditions; there has been increased interest in lifestyle and dietary approaches to reducing cardiovascular risk. Recent evidence suggests there are cardioprotective benefits from diets rich in natural fruits and vegetables, such as berries. This review will...
REVISION

Update on Uses and Properties of Citrus Flavonoids: New Findings in Anticancer, Cardiovascular, and Anti-inflammatory Activity

O. Benavente-García and J. Castillo

Research and Development Department of Nutrifur-Furfural Equitad S.A., Camino Viejo de Piego s/n, 80320 Alcantarilla, Murcia, Spain, and Members of Aging Institute of University of Murcia, Campus of Espinardo, 30100 Murcia, Spain

Significantly, much of the activity of Citrus flavonoids appears to impact blood and microvascular endothelial cells, and it is not surprising that the two main areas of research on the biological actions of Citrus flavonoids have been inflammation and cancer. Epidemiological and animal studies point to a possible protective effect of flavonoids against cardiovascular diseases and some types of cancer. Although flavonoids have been studied for about 50 years, the cellular mechanisms involved in their biological action are still not completely known. Many of the pharmacological properties of Citrus flavonoids can be linked to the abilities of these compounds to inhibit enzymes involved in cell activation. Attempts to control cancer involve a variety of means, including the use of suppressing, blocking, and transforming agents. Suppressing agents prevent the formation of new cancers from precancerous and blocking agents prevent carcinogenic compounds from reaching critical initiation.

Effects of Walnut Consumption on Endothelial Function in Type 2 Diabetic Subjects

Yonglei Li, MD, BS
Valentina Vancedu, MD, MPH
John Miller, Jr.
Suparna Dutta, MD, MPH

Kerry Dougherty, RD
Judith A. Preu, MD, RD
David L. Katz, MD, MPH

OBJECTIVE — To determine the effects of daily walnut consumption on endothelial function, cardiovascular biomarkers, and anthropometric measures in type 2 diabetic individuals.

RESEARCH DESIGN AND METHODS — This study was a randomized, controlled, single-blind crossover trial. Twenty-four participants with type 2 diabetes (mean age 58 years, 14 women and 10 men) were randomly assigned to one of the two possible sequence permutations to receive an ad libitum diet enriched with 50 g (366 kcal) walnuts daily and an ad libitum diet without walnuts for 6 weeks. Subsequently, endothelial function testing (measured as flow-mediated dilation [FMD]) and assessments of cardiovascular biomarkers before and after each 6-week treatment phase. The primary outcome measure was the change in FMD after 6 weeks. Secondary outcome measures included changes in plasma lipids, A1C, fasting glucose, insulin sensitivity, and anthropometric measures.

RESULTS — Endothelial function significantly improved after consumption of a walnut-enriched test diet compared with the ad libitum diet. Without walnuts, compared with a walnut-enriched test diet, FMD was 0.6% (95% CI -2.4% to 1.2%, P = 0.86). The walnuts-enriched diet increased fasting serum glucose and insulin by 0.9 mg/dL and 0.2 mg/dL, respectively, although these changes were not significant compared with those for the ad libitum diet without walnuts. There were no significant changes in anthropomorphic measures, plasma insulin, and insulin sensitivity.

CONCLUSIONS — A walnut-enriched diet is an effective hypolipidemic and other cardiovascular risk factors in patients with hypercholesterolemia (9,10). Despite the prevalence of endothelial dysfunctions in diabetes and evidence that walnut consumption may improve both endothelial function and biomarkers of cardiovascular disease risk in patients with hypercholesterolemia, no studies have investigated the effects of walnut intake on endothelial function in type 2 diabetes. Therefore, this study was performed to investigate the effects of a walnut-enriched diet on endothelial function and other cardiovascular risk factors.
Edible mushrooms: Role in the prevention of cardiovascular diseases


*Centro para la Calidad de los Alimentos, Instituto Nacional de Investigaciones Agrarias y Alimentarias (INIA), Campus Universitario 'Campus de Geta', 28040 Madrid, Spain.
**Departamento de Nutrición, UPF. Escola d'Estudis Avançats. Ajuntament de Barcelona, 08001 Barcelona, Spain.

ABSTRACT

Edible mushrooms are a valuable source of nutrients and bioactive compounds as well as a growing appeal for humans by their flavors and culinary features. Recently, they have become increasingly attractive as functional foods for their potential beneficial effects on human health, mainly due to their role as sources of antioxidants, vitamins, minerals, fiber, and bioactive compounds. Cardiovascular diseases are one of the major causes of mortality and morbidity in the Western world. Several investigations have shown the influence of mushrooms on lipid metabolism markers (total, LDL, HDL cholesterol, triglycerides, and insulin resistance), blood pressure, hemostatic factors, and oxidant and inflammatory markers. In addition, the role of diet in reducing the risk of cardiovascular diseases is widely acknowledged. Recent nutritional aspects of mushrooms include a high-fiber content, low fat content with low trans content of saturated fatty acids, and a low content of sodium as well as the occurrence of components such as cinnamic, phenolic, and other compounds that could be responsible for some of its bioactivity. This review provides an overview of the potential beneficial effects of edible mushrooms on cardiovascular health.
Study Conclusion:

“It appears more important to increase the number of healthy foods regularly consumed, than to reduce the number of less healthy foods regularly consumed.”

Michels K. IntlJEpidem 2002;31:847-854

Healthy Fats

- Omega 3 fatty acids
- Nuts
- Extra virgin olive oil
EPA & DHA Omega 3’s from Fish/Fish Oil?

Physicians’ Health Study

- 20,551 US male physicians followed 11-17yrs
- One fish meal per week=52% reduction in sudden death
- 90% reduction in risk of sudden death w/ higher blood n-3 fatty acids

<table>
<thead>
<tr>
<th>N-3 blood fatty acid level (%)</th>
<th>1st Quartile</th>
<th>2nd Quartile</th>
<th>3rd Quartile</th>
<th>4th Quartile</th>
</tr>
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<tbody>
<tr>
<td>Relative Risk Sudden Death</td>
<td>1.0</td>
<td>.52</td>
<td>.19</td>
<td>.10</td>
</tr>
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</table>

Albert, C. JAMA 1998;279:2328
Albert, C. NEJM 2002;346(15):1113-18
GISSI Prevention Trial

- 11,324 post MI x 2 yrs
- 4 treatment groups—
  - 1 g fish oil (850 mg EPA + DHA)
  - 1 g fish oil + 300 mg vitamin E
  - 300 mg vitamin E
  - No supplements

Gruppo Italiano, Lancet 1999;354:447-455

GISSI Prevention Trial

- Fish oil group NOT vitamin E group
- ↓ 20% total deaths
- ↓ 30% CVD deaths
- ↓ 45% sudden deaths
N-3 PUFA’s from Fish Oil: Benefits

- ↓ Ventricular arrhythmias
- Replaces AA in vascular & cardiac membrane phospholipids
- ↓ Thrombosis
- ↓ Inflammation
- ↓ Triglycerides (by inhibiting synthesis of VLDL and TG in liver)
- ↓ BP
- Improves endothelial function
- ↓ Rate of growth of atherosclerotic plaque
- ↓ Vasoconstriction

Fatty Fish/Fish Oil
AHA Recommendations

- **No CHD**: Eat 2 servings fatty fish/week

- **With CHD**: Fatty fish daily or fish oil supplement daily
  (1000mg EPA + DHA /day)=3 capsules

- **For ↑TG**: 2-4 grams fish oil/day

<table>
<thead>
<tr>
<th>3 oz. serving</th>
<th>EPA+DHA (mg)</th>
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<tbody>
<tr>
<td>Herring</td>
<td>1807</td>
</tr>
<tr>
<td>Salmon</td>
<td>1800</td>
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<tr>
<td>Mackerel</td>
<td>1571</td>
</tr>
<tr>
<td>Halibut</td>
<td>1001</td>
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<tr>
<td>Trout</td>
<td>981</td>
</tr>
<tr>
<td>Tuna</td>
<td>585</td>
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<tr>
<td>Cod</td>
<td>134</td>
</tr>
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</table>

Kris-Etherton, P. Circulation 2002;106:2747-2757
Omega-3 fatty (n-3) acids: Anti-Inflammatory Properties

- A receptor on adipocytes & adipose macrophages is activated by n-3 fatty acids and turns off their pro-inflammatory effects and turns on anti-inflammatory effects
- N-3 fatty acids regulate expression of genes involved w/ CHO & lipid metabolism
- “Food talks to genes”

Fedor D. Curr Opin Clin Nutri & Metab Care 2009; 12:138-146
Oh D. Cell2010;142:687-698

How Food talks to our Genes

Emerging Science: Nutritional Genomics

- Nutrients decide whether and when genes are expressed—extra & intracellular signals stimulate or suppress gene expression
- Begins to explain the effect of bioactive compounds on health

Nutrigenomics.ucdavis.edu
Orange juice prevented postprandial oxidative stress caused by a 900 calorie high fat meal.

By altering gene expression of proteins involved with inflammation & reducing Free Radicals

... Potent effect related to Flavonoids in orange juice

Orange juice helps reduce inflammation of high fat high glucose meal
Olive Oil
A mono-unsaturated fat

Olive Oil: Benefits

- ↓ inflammatory cytokine production
- Lowers total & LDL cholesterol 5-7%
- Maintains HDL & lowers TG’s
- ↓ risk of thrombogenesis
- ↓ LDL oxidation
- ↓ BP
- ↓ Arachidonic acid (AA) production and prostaglandin’s

Unique Features of Extra Virgin Olive Oil

- Contains significant fat soluble “minor” phytonutrients

Extra virgin olive oil vs. other oils

- Olive oil is produced by a cold-press mechanical process

- High in polyphenols and other compounds not found in grain oils—tocopherols, carotenoids, phytosterols, flavonoids, rutin, squalene and more.

Stark, A. Nutr Rev 2002;60:170-176
“Refining”

Nuts:
Nut Studies

- **Nurses’ Health Study**: 5 oz. nuts weekly had 35% reduction in nonfatal MI
- **Physicians’ Health Study**: nuts 2 or more times per week had 47% reduced risk of sudden cardiac death and 30% reduced risk of CHD death
- 31,208 Seventh-Day Adventists followed for 6 years
  Nuts 4x/week=51% fewer MI's
- Nut intake in Mediterranean & Asian diets—populations with lower CHD risk

Jiang R. *JAMA* 2002;288:2554-2560

Nut Benefits

- Prevents type 2 diabetes
- Reduces insulin resistance
- Reduces MI risk
- Lowers LDL cholesterol 9-20%
- Anti-thrombotic
- Anti-oxidant
- Anti-inflammatory

Jiang R. *JAMA* 2002;288:2554-2560
Review

Nuts, inflammation and insulin resistance

Patricia Casas-Agustench BSc,1,2, Mònica Bulló BSc, PhD,1,2, Jordi Salas-Salvadó MD, PhD1,2

1Human Nutrition Unit, Hospital Universitari Sant Joan de Reus, IISPV, Universitat Rovira i Virgili, Reus, Spain
2CIBER Fisiopatología de la Obesidad y Nutrición (CIBEROBN), Instituto de Salud Carlos III (ISCIII), Santiago de Compostela, Spain

The beneficial effects of nut consumption on cardiovascular disease (CVD) have been widely documented. These protective effects are mainly attributed to the role of nuts in the metabolism of lipids and lipoproteins. As chronic inflammation is a key early stage in the atherosclerotic process that predicts future CVD events and is closely related to the pathogenesis of insulin resistance, many recent studies have focused on the potential effect of nut consumption on inflammation and insulin resistance. Through different mechanisms, some components of nuts such as magnesium, fiber, ol-malic acid, L-arginine, antioxidants and MUFA may protect against inflammation and insulin resistance. This review evaluates the epidemiologic and experimental evidence in humans demonstrating an association between nut consumption and these two emergent cardio-protective mechanisms.

Key Words: nuts, inflammation, insulin resistance, type 2 diabetes, cardiovascular disease

Nuts Consumption & MI

31,208 Seventh-Day Adventists followed for 6 years
Nuts 4x/week = 51% fewer MI’s

Fraser, G. Arch Int Med 1992;152:1416-1424
Healthy Fats
What to tell your patients:

- Eat fatty fish often 2+/week—salmon, herring, mackerel—don’t fry it OR 1000mg EPA/DHA/day with meal—1/2 tsp. liquid or 3 capsules

- Use extra virgin olive oil daily in low heat cooking/simmering & on salads (1-2Tbsp/day)

- Eat 10-20 nuts daily—preferably not roasted—best choice—almonds or walnuts

Vitamin D Deficiency: An Important, Common and Easily Treatable Cardiovascular Risk Factor?

JACC 2008
Anti-Inflammatory Diet

- Healthy Fats
  - Fatty Fish—N-3 PUFA’s
  - Extra virgin olive oil
  - Nuts
  - Flax seeds
  - Other unrefined oils

- Vegetables

- Fruits
  - Berries

- Whole Grains

- Special foods/supplements
  - Dark Chocolate
  - Red wine
  - Green & white teas
  - Spices—Turmeric, Rosemary, etc.
  - Vitamin D3 supplement
What do we do? Where do we go from here?

- 25% eat fast food daily
- Average 22tsp sugar/day = 350 calories
- 45% no daily fruit
- 22% no daily vegetable (chips/fries are vegetables?)
- 36% 1 serving daily whole grain

How did Norm tame the Adipocyte?
Diet & CV Inflammation

**Pro-inflammatory Foods**
- ↑ Inflammatory triggers—TNF, IL-6
- ↑ Free Radicals/Oxidative stress
- ↑ Lipidemia (TG, VLDL)
- ↑ Free fatty acids
- ↑ Glucose

**Anti-inflammatory Foods**
- ↓ Inflammatory triggers—TNF, IL-6
- ↓ Free Radicals/Oxidative stress
- ↓ Lipidemia (TG, VLDL)
- ↓ Free fatty acids
- ↓ Glucose

Norm’s Diet:
“Cut out Processed Foods . . . Eat Real Foods!”

**Breakfast**
- Chopped Fruit/Nuts
- Oatmeal
- 1/4c. Ground flax seeds
- Whole wheat toast
- ¼ grapefruit
- 1 date
- 6 oz. v-8 juice

**Lunch**
- Salad or soup with veges, dry beans, barley, salmon
- occasionally olive oil & vinegar on salad

**Dinner**
- Veges, beans PB & WW crackers salmon

**Snacks:** Snap peas, few nuts, veges

**Norm choose to eliminate:** Meats, poultry, bread, cold cereal, rice, pasta, potatoes, sweets, juices, fried foods, white flour foods
Sam Gadless: Unhealthy most of his life—smoked, high BP, cholesterol and diabetes at 70 years of age. Bad genes too.

Decides to walk and eat veges, beans, salmon, garlic, etc—“eating healthy”. He makes headlines when he runs the NY Marathon at 91 years old.

I’d like for you to lose 25 lb. It would help your blood pressure and reduce back pain. Regular exercise would help too.
I’d like for you to lose 25#. And, try avoiding all white foods.

You know every year I have needed to add more medications to your list. Would you be interested in a few visits with the dietitians at our Diabetes Clinic? They are very helpful in teaching my patients how to make a few food changes that can reduce the need for medications. Shall I give you a referral?
You know every year I have needed to add more medications to your list. Are you aware of how healing your food choices can be? There is really good research that reducing intake of processed foods and increasing intake of healthy foods is very helpful. Here are some suggestions:

1. Take 2 fish oil pills everyday or eat salmon, sardines or mackerel 3x/wk.
2. Take 2000iu vitamin D3 each day.
3. Eat a piece of fruit every day for breakfast and lunch.
4. Eat some colorful vegetables for lunch and dinner each day.
5. Eat 15 almonds or walnuts each day.
6. Change to mostly whole grains
7. Use extra virgin olive oil daily in cooking or on salads
8. Limit to 1 small serving of a sweet each day
Hippocrates: Father of Medicine

“Let Food be thy Medicine . . . and Medicine be thy Food.”

350 B.C.