Introduction To Anti-Inflammatory Nutrition
Why Do We Gain Weight, Get Sick, and Age Faster?
THE SECRET KILLER

The surprising link between INFLAMMATION and HEART ATTACKS, CANCER, ALZHEIMER'S and other diseases

What you can do to fight it
Chronic Diseases Associated With Excess Inflammation

• Obesity
• Metabolic Syndrome
• Type 2 Diabetes
• Heart Disease
• Cancer
• Neurological
  – Alzheimer’s, Depression, ADHD, Parkinson’s
• Auto-immune
  – Type 1 Diabetes, RA, Multiple Sclerosis
• Asthma
• Allergies
• Other inflammatory conditions (“itis”)
What Is Inflammation?

• Ancient Greeks
  – Internal Fire

• Ancient Romans
  – Heat
  – Pain
  – Swelling
  – Redness
What Is Inflammation?

• Complex orchestration of pro-inflammatory and anti-inflammatory events
• Usually associated with pain
• Mediated by eicosanoids
• Treated by drugs that alter eicosanoids
  – Aspirin
  – NSAID’s
  – COX-2 inhibitors
  – Steroids
But You Need A Zone

• Too little of an inflammatory response
  – Sitting target for microbes
  – Injuries never heal

• Too much of an inflammatory response
  – The body attacks itself
Events That Turn On Inflammatory Responses

- Microbial invasion
- Injuries
- Diet
Overview Of Anti-Inflammatory Nutrition
The Science Of The Zone

- Improved hormonal control
- Resolution of inflammation
- Control of gene expression
Unique Roles For Each Dietary Intervention

• Zone Diet
  – Reduction of the initiation of inflammation

• Omega-3 Fatty Acids
  – Acceleration of the resolution of inflammation

• Polyphenols
  – Slowing of the aging process
Benefits Of Being In The Zone

• Reduce the likelihood of chronic disease

• Slow the rate of aging

• Defines the clinical markers of wellness
Clinical Markers That Define The Zone

• **AA/EPA ratio**
  – Marker of inflammation
  – Maintain between 1.5 and 3

• **TG/HDL ratio**
  – Marker of insulin resistance
  – <1 (mg/dl) or <0.4 (mmol/l)

• **HbA₁C**
  – Marker of long-term glycemic control
  – 5%
Our Two Immune Systems

• Innate (Strongly affected by the diet)
  – Primitive
  – Early response
  – Based on pattern recognition

• Adaptive (Weakly affected by the diet)
  – More advanced
  – Slowly responding
  – Based on memory
Innate Immune System Made Simple

Toll-Like Receptors (TLR) and AGE Receptors (RAGE)

NF-κB

AA

PPARγ

DNA

Inflammatory Enzymes (COX-2) And Cytokines (IL-1, IL-6, TNF)

Cytokine Receptors
Dietary Controls on NF-κB Activity

- Omega-6 Fatty Acids, Saturated Fatty Acids, Excess Carbs, and Excess Calories
- Zone Diet, Omega-3 Fatty Acids, and Polyphenols
Phases Of Inflammation

Initiating Event

Pro-inflammatory Initiation Response
Cellular Destruction

Anti-Inflammatory Resolution Response
Cellular Rejuvenation
What Is Cellular Inflammation?

- Mismatch between the initiation and resolution of inflammation
- Chronic activation of innate immune system
- Inflammation below the perception of pain
What Causes Cellular Inflammation?
The Perfect Nutritional Storm

• Increased Omega-6 Consumption

• Increased Refined Carbohydrate Consumption

• Decreased Omega-3 Consumption

• Decreased Polyphenol Consumption
How It Happens

Omega-6 Fatty Acids

Activated by Insulin
Inhibited by Omega-3 Fats

Arachidonic Acid

Cellular Inflammation
Three Stages Of Disease

Wellness

Cellular Inflammation

Chronic Disease
The Best Way To Reach the Zone Is Through The Anti-Inflammatory Zone Diet
Anti-Inflammatory Supplements For The Anti-Inflammatory Zone Diet:

*Fish Oil and Polyphenols*
Omega-3 Fatty Acids:

*Putting Our the Inflammatory Fire*
Clinical Benefits Of High-Dose Fish Oil

- Heart Disease
- Cancer
- Depression
- Attention Deficit Disorder
- Multiple Sclerosis
- Brain Trauma
- Alzheimer’s
- Chronic Pain
- Osteoporosis
- Skin Disorders
- Fertility
- Fat Loss
Polyphenols:

The Color of Anti-Inflammation Nutrition
Mechanisms Of Action

• Anti-oxidants

• Anti-inflammatory

• Anti-aging
A New Powerful Message

- Diet can *turn on* inflammatory genes
- Diet can *turn off* inflammatory genes
Treating Nutrition As Gene Therapy

- Zone Diet
- Omega-3 Fatty Acids
- Polyphenols

INFLAMMATORY GENES
Why Anti-Inflammatory Nutrition Is Important

- Cellular Inflammation
- Obesity
- Diabetes
- Alzheimer’s
The Zone Diet
Beginnings Of The Zone Diet

• Epidemiological studies of Greenland Eskimos (mid-1970s)
  – Little heart disease, cancer, depression, multiple sclerosis, etc.
  – Diet rich in omega-3 fatty acids

• 1982 Nobel Prize in Medicine
  – Role of eicosanoids in inflammation
Food As A Drug

Food

Macronutrients
(Carbohydrates, Proteins, Fat)

Hormonal Response
(Insulin, Glucagon, Eicosanoids)
Insulin
Storage Hormone

Glucagon
Mobilization Hormone

Eicosanoids
Master Hormone
Eicosanoids Are Controlled By Dietary Fat And Insulin

Dietary Fat

Essential Fatty Acids

Glucagon

“Good” Eicosanoids

Insulin

“Bad” Eicosanoids
The Zone Diet is Based Upon the Balance of the Protein-to-Glycemic Load

<table>
<thead>
<tr>
<th>Protein-to-Glycemic Load Ratio</th>
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<tbody>
<tr>
<td>High-Carbohydrate Diets</td>
</tr>
<tr>
<td>Zone</td>
</tr>
<tr>
<td>Ketogenic Diets</td>
</tr>
<tr>
<td>Excess Dietary Glucose</td>
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<tr>
<td>Insulin Balance</td>
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<tr>
<td>Deficient Dietary Glucose</td>
</tr>
<tr>
<td>Fat Accumulation</td>
</tr>
<tr>
<td>Loss of Inflammatory Fat</td>
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<tr>
<td>Cortisol Increase</td>
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How We Get Fat

Graph showing the increase in loss-adjusted calories per capita from 1970 to 2010. The graph indicates a 20% increase, with a rise of 425 kcal/day.
Why Not Eat Less, Exercise More?

• Eating less increases biological defense mechanisms that increases hunger

• Exercising more increases hunger
Why Are We Fatter?
Dietary “Answers” In The Early 1990s

• Fat makes you fat
  – If no fat touches your lips, no fat reaches your hips
  – Can eat more food, and not gain weight
  – Ornish diet (very-low fat diet)

• Carbs makes you fat
  – Replace carbs with even more fat
  – Can eat more food and not gain weight
  – Atkins diet (ketogenic diet)
What Is Metabolism?

• Conversion of dietary calories into chemical energy (ATP)
• Fat is high-octane fuel for ATP production
• The Fat Trap
  – Excess dietary calories get trapped in your fat cells and can’t get out to be converted into ATP
What Causes A Fat Trap?

- Diet
- Inflammation
- Insulin Resistance
- Fat Trap
A Third Choice Appears In 1995

• Inflammation makes you fat
  – Blood, brain, and the gut
  – Have to reduce calories, but without hunger or fatigue
  – Zone Diet
Zone Diet
Recommendations (1995)

• 40% low-glycemic load carbs

• 30% low-fat protein

• 30% monounsaturated fat, but low in omega-6 and saturated fats

• 1,200 to 1,500 calories per day
Dietary Guidelines From The Joslin Diabetes Research Center At Harvard (2007)

- 40% low glycemic load carbs
- 20-30% low-fat protein
- 30-40% monounsaturated fat
- 1,200 to 1,500 calories per day
Per Cent Calories On A 40-30-30 Dietary Balance Can Be Deceiving

<table>
<thead>
<tr>
<th>Macronutrient</th>
<th>1,200 calories/day</th>
<th>1,500 calories/day</th>
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<tbody>
<tr>
<td>Carbohydrate</td>
<td>120 g/day</td>
<td>150 g/day</td>
</tr>
<tr>
<td>Protein</td>
<td>90 g/day</td>
<td>112 g/day</td>
</tr>
<tr>
<td>Fat</td>
<td>40 g/day</td>
<td>50 g/day</td>
</tr>
</tbody>
</table>
What 1,200 Calories Per Day Represents On The Zone Diet

- **Carbohydrates (120 grams)**
  - 8 servings (500 g or 4 cups) of cooked vegetables
  - 2 servings (200 g or 1 cup) of fresh fruit
  - 1 serving each of lentils (1/2 cup) and oatmeal (1/2 cup)
  - Provides >40 grams of total fiber

- **Protein (90 grams)**
  - Low-fat protein sources

- **Fat (40 grams)**
  - 2 tablespoons of extra virgin olive oil
Zone Diet and Hormonal Balance
Zone Diet Induces Rapid Changes in Hormonal Responses

**Serum Insulin (change)**

![Graph showing serum insulin levels over time for different meals.]

**Plasma Glucagon (change)**

![Graph showing plasma glucagon levels over time for different meals.]

Zone Diet and Reduction of Inflammation
The Zone Diet Reduces Cellular Inflammation

The Zone vs. Ketogenic Diets
Weight Loss

Fat Loss

Energy

Ketogenic Diets Increase Cellular Inflammation

Metabolic Changes On A Ketogenic Diet

• 18% increase in cortisol levels

• 12% decrease in T₃ levels

Key Points Of The Zone Diet

• Calories do count
• You need adequate protein
• Balance your plate to balance your hormones
• Reduce omega-6 and saturated fat
• Consume colorful carbs
• Fermentable fiber is important
Reducing Insulin Resistance Is The Key Benefit Of The Zone Diet
What Is Insulin Resistance?

- Inability to transit insulin signal to interior of the cell
- Hormonal communication is garbled
- Caused by increased inflammation
- Insulin is the central point for metabolism
Insulin Resistance Is Highly Organ Dependent
Hypothalamus

• Balances of energy intake and expenditure
  – Satiety signals from gut matched to hormonal signals (leptin and insulin) from the blood

• Sensitive to excess calories and saturated fats
  – ER stress and inflammation
Hypothalamic Inflammation Is Rapid

- Within 24 hours of HFD
- Precedes any weight gain

- Fatty acid sensors
  - Palmitic acid and TLR-4 receptors
    - Pro-inflammatory
  - Omega-3 and oleic acids
    - Anti-inflammatory
Liver

• Can start earlier than adipose tissue
  – 3 days after HFD
  – Connection to hypothalamus via vagus nerve

• Increase in cholesterol levels

• Development of fatty liver
  – 25% of all Americans
  – 90% of type 2 diabetics
Adipose Tissue

- Expansion of existing fat cells
- Hypoxia of expanded fat cells
- Healthy fat cells turning sick and then dying creating more inflammation
Muscle

• Primary site for glucose uptake

• Inflammatory cytokines from adipose tissue and liver disrupt glucose uptake
Zone Diet: An Anti-Inflammatory Diet

Key Aspects:
- Based on the glycemic load
- Balance of protein, carbohydrates, and fat

What’s Driving Physician Interest:
- Diet without hunger and fatigue
- Flexibility
- Moderate approach

Implications:
- Long-term compliance
- Medically validated
How Difficult Is To Follow The Zone Diet?
Start With:

Low-Fat Protein
Balance With:

- Colorful Carbohydrates
- Low-Fat Protein
Finally Add Fat!

<table>
<thead>
<tr>
<th>Good Choices</th>
<th>Extremely Bad Choices</th>
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<tr>
<td>▪ Low in Omega-6 and Saturated Fats</td>
<td>▪ High in Omega-6 Fats</td>
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Zone Food Pyramid

Vegetables

Fruits

Low-fat Protein

Monounsaturated Fat

Grains and Starches (Use in Moderation)
The Zone Diet Is A Blueprint For Hormonal Balance, Not A Philosophy

• Vegan Zone
  – No animal protein, no dairy or egg protein
• Lacto-ovo Vegetarian Zone
  – No animal protein
• Paleo Zone
  – No legumes, no dairy protein
• Omnivore Zone
  – No restrictions on protein sources
The Zone Diet Is The Evolution Of The Mediterranean Diet

• It’s Mediterranean ingredients with the Zone blueprint for hormonal balance

• The more white you put on the plate, the more inflammation you create
Effect Of Diet On NF-κB Activity In Humans

• High glycemic load diet increases NF-κB activity

Dickinson et al AJCN 87:1188 (2008)
The Best Way To Reduce Cellular Inflammation

• Take omega-6 fats out of the diet
  – Reduce raw materials needed to produce arachidonic acid

• Reduce the use of high-glycemic carbs
  – Lower insulin making it more difficult to produce arachidonic acid from omega-6 fatty acids
What Can You Expect?

- **2-3 Days**
  - Lack of hunger
  - Better mental focus

- **3-4 Days**
  - Surge of physical energy

- **7 Days**
  - Clothes are fitting better

- **14 Days**
  - Better handling of stress

- **30 Days**
  - Greatly improved blood chemistry
Here’s The Problem

• Omega-6 fatty acids are the most inexpensive calories in the world

• Refined carbohydrates are the foundation of processed foods

• It’s easier to change your religion than to change your diet
An Alternative Way To Reduce Cellular Inflammation:

Anti-Inflammatory Supplements