Turning Down the Heat
The Effects of Diet and Nutritional Supplements on Inflammation and Repair

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What do these people have in common?
Inflammatory Triggers

- Age-related wear and tear
- Physical injuries
- Infections
- Environment
- Adverse food reactions
- Autoimmune diseases

- Dietary imbalances and deficiencies
- Fluctuating blood sugar
- Hormonal imbalance
- Genetics
That's odd... my neck suddenly feels better...

EARLY ACUPUNCTURE
Steps of the Inflammatory Response

The inflammatory response is a body's second line of defense against invasion by pathogens. Why is it important that clotting factors from the circulatory system have access to the injured area?

1. Damaged tissues release histamines, increasing blood flow to the area.

2. Histamines cause capillaries to leak, releasing phagocytes and clotting factors into the wound.

3. Phagocytes engulf bacteria, dead cells, and cellular debris.

4. Platelets move out of the capillary to seal the wounded area.
Mediators of Acute Inflammation

**Vasodilation**
- Prostaglandins E₂, D₂, F₂α, I₂
- Nitric Oxide

**Increased Vascular Permeability**
- Histamine, Serotonin
- Bradykinin
- C3a and C5a (through liberating amines)
- Leukotrienes C₄, D₄, E₄
- PAF (AGEPC)
- Oxygen free radicals

**Chemotaxis**
- C5a
- Leukotriene B₄
- IL-8
- Bacterial products

**Pain**
- PGE₂
- Bradykinin

**Fever**
- IL-1, IL-6, TNF
- PGE₂

**Tissue Damage**
- Neutrophil and macrophage lysosomal enzymes
- Oxygen derived free radicals
- Nitric Oxide
Cumulative Injury Cycle
Chronic Inflammation

- Cumulative Sheer & Repetitive Stress
- Altered neuromuscular control
- Adhesions
- Muscle Imbalance & Joint Dysfunction
- Muscle Spasm & Trigger Points
- Tissue trauma
- Inflammation

Modified from the NASM
MYOFASCIAL PAIN SYNDROMES

A myofascial trigger point is a highly localized and hyper-irritable spot in a palpable taut band of skeletal muscle fibers.
TRIGGER POINT SYMPTOMS

1. Local or referred pain
2. Pain with muscle contraction
3. Muscle stiffness and restricted joint motion
4. Muscle weakness
5. Paresthesia and numbness
6. Proprioceptive disturbance
7. Autonomic dysfunction
8. Edema and cellulite
Nutritional Inadequacies

- Travell and Simons - ~ half of their patients with myofascial pain syndromes required resolution of vitamin inadequacies for lasting relief

- Vitamin inadequacies lead to:
  - Impaired cell metabolism and function
  - Decreased synthesis of neurotransmitters and DNA
  - Impaired collagen synthesis and reduced nerve and muscle function
  - Increased irritability of trigger points and nerves

- Nutrients of special concern in patients with myofascial pain are the water-soluble vitamins B1, B6, B12, folic acid, vitamin C and minerals such as calcium, magnesium, iron and potassium

Biochemistry of n-3 and n-6 Fatty Acids Simplified

- D6D and D5D are rate limiting enzymes
- Delta 6 desaturase requires: Vitamin B6, magnesium and zinc as cofactors
- Delta 5 desaturase requires: Vitamin C, niacin and zinc as cofactors
- If the diet is >4:1 (n-6:n-3) the production of pro-inflammatory prostaglandins is favored
  - The S.A.D. is significantly greater than 4:1 (closer to 20:1)
- Sugar increases insulin, promoting arachidonic acid metabolism, resulting in inflammation
- Other factors include stress, disease state, age and environmental factors
Key Micronutrients in Eicosanoid Synthesis

**Omega 3 fatty acids:** DGLV, flax, hemp, walnut, cold water fish

**Omega 6 fatty acids:** grains, seed oils

**B6:** garlic, tuna, cauliflower, mustard greens, banana, celery, cabbage, mushrooms, asparagus, broccoli, kale, collard greens, Brussels sprouts, cod and chard.

**Mg:** Swiss chard and spinach, mustard greens, summer squash, broccoli, blackstrap molasses, halibut, turnip greens, pumpkin seeds, peppermint, cucumber, green beans, celery, kale and a variety of seeds, including sunflower seeds, sesame seeds, and flax seeds.

**Zn:** Mushrooms and spinach, sea vegetables, spinach, pumpkin seeds, yeast, beef, lamb, summer squash, asparagus, venison, chard, collard greens, miso, shrimp, maple syrup, broccoli, peas, yogurt, pumpkin seeds, sesame seeds and mustard greens.

**B3:** Mushrooms, tuna, halibut, asparagus, sea vegetables, venison, chicken, and salmon.

**C:** Broccoli, bell peppers, kale, cauliflower, strawberries, lemons, mustard and turnip greens, Brussels sprouts, papaya, chard, cabbage, spinach, kiwifruit, snow peas, cantaloupe, oranges, grapefruit, limes, tomatoes, zucchini, raspberries, asparagus, celery, pineapples, lettuce, watermelon, fennel, peppermint and parsley.

Source: www.whfoods.org
Normal Oxygen Atom
Electron Loss Creates Free Radical

Free Radicals Set Off Chain Reaction
Cell Membrane

Erosion of Cell Membrane

Antioxidant
Antioxidant Neutralizes Free Radical
Antibodies (immunoglobulins): produced by the immune system in an attempt to protect the body from foreign invaders (antigens)

- IgE: immediate reaction
- IgG: delayed reaction (AKA sensitivity)

- IgE and/or IgG: bind with antigens to form an “immune complex” which activates mast cells, triggering degranulation

- Mast cell degranulation results in the release of pro-inflammatory chemicals: histamine, chemotactic chemicals, enzymes and eicosanoids
Common Foods that Cause Adverse Food Reactions

- Milk
- Eggs
- Wheat
- Corn
- Tomatoes
- Soy
- Nuts
- Shellfish/fish
- Citrus
- Food coloring and preservatives
- Coffee
- Chocolate
- What do you crave and eat every day?
Food Allergy and Digestion

The Small Intestine

Food particles which have been broken down into small enough size for absorption.

These particles can either ferment or get absorbed across the intestinal mucosa.

Secretory IgA antibodies

Poorly digested food particles due to lack of HCL, pancreatic enzymes, bile salts, poor mastication and or excessively rapid transit.

Lumen

The absorptive surface of the small intestine covered over with mucus and secretory IgA antibodies.

When foreign substances, such as large unbroken down food particles, cross the intestinal membrane, the body’s immune system makes antibodies against them. These antibodies can attack the food particles, yeast proteins, and other foreign substances producing immune complexes which can cause inflammation and other problems.

Interstitial Fluid

Bloodstream

Leaky Gut Syndrome can result from inflammation of the intestine, parasites, medications such as cortisone, and allergies. This allows larger particles of food or other proteins to cross the mucosa.

Formation of food specific IgA, IgG, or IgE antibodies (unbound)

Food-Immune Complexes

Composed of food-specific IgA, IgG and/or IgE antibodies, if not cleared from circulation, may deposit in tissues and initiate a host of allergic responses.

adapted from Nutritional Dietetics; Percival & Yevka
Factors Affecting Tissue Healing and Repair

- Damaged soft tissue is continually re-injured
- Prolonged NSAID use (e.g. Ibuprofen, Naproxen)
- Other medications (e.g. statins, steroids)
- Systemic factors: immune compromise, diabetes, peripheral vascular disease, aging, genetics
- Nutritional status
- Diet (inflammatory or anti-inflammatory)
Effects of NSAIDs on Healing

- Impede tendon, bone and cartilage repair and delay of muscle regeneration
- Block protein synthesis in muscle
- Inhibit collagen matrix synthesis and accelerate cartilage destruction
- Interfere with satellite cell formation
- Common side effects include tinnitus, gastric irritation, GI upset, headaches

BOTTOM LINE: NSAIDs lead to inadequately formed connective tissue that is easily re-injured (Cumulative Injury Cycle) and prone towards degenerative changes.
Turning Down the Heat with Whole Foods
The official College Food Pyramid

- Food which will very likely poison you
- Buffalo Wings
- Beer, Soda, Red Bull, Coffee
- Condiments*
- Carbs (Ramen, tortillas, etc)
- Food from vending machines

* free at many restaurants
The Power of Color
Phytonutrients as Antioxidants

- **RED** (anthocyanidins, lycopenes) - strawberries, cranberries, raspberries, cherries, grapes, beets, pomegranates, bell peppers
- **ORANGE-YELLOW** (beta carotene, letein, zeaxanthin) - carrots, sweet potatoes, oranges, mangoes, cantaloupe, pumpkin, apricots, turmeric, ginger
- **GREEN** (beta carotene, lutein) - spinach, chard, kale, avocado, asparagus, broccoli, Brussels sprouts, watercress, green tea, olives
- **BLUE-PURPLE** (anthocyanidins) - blueberries, blackberries, plums, prunes
- **WHITE** - garlic, onion, cauliflower
- **BLACK/BROWN** - coffee, dark chocolate, black tea

Salicylates found in diets high in fruits and vegetables can produce salicylic acid concentrations equal to 75 - 150 mg aspirin per day (Hare, LG, et al. Dietary Salicylates. J Clin Pathol. 2003 September; 56(9): 649–650.)
# Anti-Inflammatory Foods: Oils/Fats

<table>
<thead>
<tr>
<th>Food</th>
<th>Phytochemicals/Properties</th>
<th>Mechanism</th>
<th>Dose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extra-Virgin Olive Oil</td>
<td>Polyphenols</td>
<td>COX-1 and COX-2 inhibitors</td>
<td>3 ½ tbsp = 200 mg Ibuprofen(^1)</td>
</tr>
<tr>
<td>Flaxseed oil</td>
<td>ALA</td>
<td>Precursor to EPA, DHA &amp; anti-inflammatory eicosanoids</td>
<td>1-2 tbsp oil or 1-2 capsules daily (7 grams ALA per 15 mL or 1 tbsp)</td>
</tr>
<tr>
<td>Walnuts</td>
<td>ALA &amp; polyphenols</td>
<td>Anti-oxidants; increase PGE-1 and PGE-3</td>
<td>1.5 oz walnuts/day</td>
</tr>
<tr>
<td>Food</td>
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<td>Mechanism / Outcomes</td>
<td>Dose</td>
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</tr>
<tr>
<td>Cherries</td>
<td>Anthocyanidins</td>
<td>Drinking tart cherry juice could reduce pain and damage in muscles induced by exercise ²; flavonols &amp; anthocyanins exert anti-inflammatory effects</td>
<td>24 oz tart cherry juice per day</td>
</tr>
<tr>
<td>Pomegranates</td>
<td>Polyphenols &amp; flavonoids</td>
<td>Reduces pro-inflammatory cytokines and eicosanoids; strong antioxidants ³</td>
<td>Drinking 8 - 12 oz. of pomegranate juice per day</td>
</tr>
<tr>
<td>Tomatoes</td>
<td>Lycopene</td>
<td>Reduces TNF-α production ⁴</td>
<td>16 oz</td>
</tr>
<tr>
<td>Food</td>
<td>Phytochemicals/Properties</td>
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<td>Dose</td>
</tr>
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</tr>
<tr>
<td>Dark chocolate</td>
<td>Polyphenols</td>
<td>Increases antioxidant status before exercise and reduces levels of F2-isoprostane 1 hr after exercise⁵</td>
<td>100 grams of dark (70%) chocolate</td>
</tr>
<tr>
<td>Ginger</td>
<td>Gingerols, shogaols, and paradols</td>
<td>Suppresses cytokines &amp; chemokines⁶</td>
<td>5 g of raw ginger or 0.1-1g of powdered</td>
</tr>
<tr>
<td>Green tea</td>
<td>Catechin polyphenols (epigallocatechin gallate – EGCG)</td>
<td>Down-regulates IL-8, macrophages &amp; PGE-2⁷</td>
<td>24 – 36 oz/day</td>
</tr>
<tr>
<td>Probiotics</td>
<td>Beneficial microflora</td>
<td>Balances activity of T-lymphocytes. Reduces NF-kB and TNF⁸</td>
<td>Yogurt or supplement with 8 billion live active cultures bid</td>
</tr>
<tr>
<td>Red wine</td>
<td>Resveratrol</td>
<td>Reduces CRP⁹</td>
<td>1-2 glasses/day</td>
</tr>
</tbody>
</table>
Anti-Inflammatory Tips

1. Eat a variety of fresh, whole, local, seasonal and organic foods
2. Cold water fish
3. Lean, free-range, 100% grass-fed meat
4. Fiber from non-starchy vegetables and fruits
5. Use XVOO, almond oil, walnut oil, avocado oil, coconut oil and avoid conventional, chemically processed cooking oils
6. Flavor foods with spices and herbs (e.g. garlic, ginger, onion, turmeric, cayenne)
7. Snack on raw nuts and seeds
8. Avoid refined carbohydrates, sugar and HFCS
9. Opt for water or green tea when thirsty
10. Identify and avoid food allergies/sensitivities
Healthy Plate

- **Protein**
  - Beef (grass fed)
  - Poultry (w/o skin)
  - Wild game
  - Fish
  - Dairy (Yogurt)
  - Eggs
  *Grass-fed/Free-range, organic when possible

- **Starch**
  - Sweet potatoes
  - Squash
  - Brown/wild rice
  - Quinoa
  - Oats

- **Non-starchy veggies - raw or lightly cooked**
  - Broccoli
  - Cabbage
  - Carrots
  - Cauliflower
  - DGLV (e.g. Spinach, kale, chard, Brussels sprouts etc.)
  - Green beans
  - Onions
  - Peppers
  - Tomatoes
  - Herbs/spices

- **Healthy fats, including avocado, XVOO and nuts**
- **Fruit for snacks**
- **Water, wine, green tea, coffee**
- **Dark chocolate**
Organic or Non-organic

- **Dirty dozen** (celery, peach, strawberry, apple, blueberry, nectarine, bell pepper, lettuce, cherries, kale, potato, grape)*

- **Clean 15** (onions, avocado, corn, pineapple, mango, pea, asparagus, kiwi, cabbage, eggplant, cantaloupe, watermelon, grapefruit, sweet potato, honeydew melon)*

- Toxic load – pesticides are pro-inflammatory because they cause cell damage and produce free radicals

*Environmental Working Group (www.ewg.org)
# Anti-inflammatory Botanical Medicines

<table>
<thead>
<tr>
<th>Botanical Medicine</th>
<th>Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Boswellia</strong> - large native tree of India</td>
<td>Inhibits lipoxygenase activity. Affects glycosaminoglycan synthesis and improves blood supply.</td>
</tr>
<tr>
<td><strong>Bromelain</strong> - proteolytic enzymes from the stem of pineapple</td>
<td>Promotes fibrinolysis, inhibits kinins and PGE2s and stimulates PGE1.</td>
</tr>
<tr>
<td><strong>Curcumin</strong> - yellow pigment that is the active component of turmeric. Well documented in over 2000 studies.</td>
<td>Decreases platelet aggregation, cytokines, kinases fibrinolysis and macrophage activity.</td>
</tr>
<tr>
<td>Olygomeric Proanthocyanidins (OPCs), e.g. pycnogenol and other bioflavonoids</td>
<td>Inhibits lipoxygenase activity (PGE2 and LTB4). COX 1 and COX 2 inhibition. Decreases affects of bradykinin. Affects cytokines, collagen cross-linkage and connective tissue. Antioxidant.</td>
</tr>
<tr>
<td><strong>Quercetin</strong> - apples, onions, teas, berries, vegetables of the cabbage family, seeds, and nuts</td>
<td>Inhibits lipoxygenase activity and histamine. Decreases neutrophil lysosomal enzyme activity and lipid peroxidation.</td>
</tr>
</tbody>
</table>
## Anti-inflammatory Supplements

<table>
<thead>
<tr>
<th>Supplement</th>
<th>Description/Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black current oil/Evening primrose oil/Borage oil (GLA)</td>
<td>See fish oil</td>
</tr>
<tr>
<td>Chondroitin Sulfate (GAG)</td>
<td>Glycosaminoglycan that affects chondrocytes and articular cartilage</td>
</tr>
<tr>
<td>CoQ10</td>
<td>Affects creatine kinase and lactate dehydrogenase (not via inflammatory process). Anti-oxidant. Reduces CRP. Affects cytokines.</td>
</tr>
<tr>
<td>Fish Oil (EPA and DHA)</td>
<td>Changes balance of PGs and LTs. Decreases PGE2, TXE2 and LTB4. Increases PGE1, TNF, IL1. Slows AA production.</td>
</tr>
<tr>
<td>Glucosamine Sulfate</td>
<td>Building block of proteoglycans (ground substance of articular cartilage.</td>
</tr>
</tbody>
</table>

**NOTE:** Pregnant women and people taking medications should consult a physician or pharmacist before taking supplements due to potential interactions. A good resource is [Food-Medication Interactions](#) by Zaneta M. Pronsky.
# Anti-inflammatory Supplements

<table>
<thead>
<tr>
<th>Vitamin C</th>
<th>Anti-oxidant and anti-histamine. Promotes collagen and elastin formation.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vitamin D</td>
<td>Low D3 levels are associated with markers of endothelial dysfunction and inflammatory activation. Normal range is 30.0 to 74.0 nanograms per milliliter (ng/mL) 25-hydroxy vitamin D</td>
</tr>
<tr>
<td>Vitamin E (mixed-tocopherols)</td>
<td>Protects lysosomal and other membranes which may inhibit histamine and serotonin. Inhibits chemotaxis. Increases glutathione peroxidase.</td>
</tr>
<tr>
<td>Magnesium</td>
<td>Needed for collagen synthesis and bone density; deficiency associated with free radicals, cytokines, histamine and Substance P.</td>
</tr>
<tr>
<td>Whey Protein</td>
<td>Production of collagen and repair of the extracellular matrix; important for wound remodeling; antioxidant</td>
</tr>
</tbody>
</table>
Supplement Dosages

- Antioxidants: A, E, C, Se, Zn (e.g. Carlson’s ACES+Zn)
- Boswellia (standardized extract of boswellic acids 37.5%): 400mg 3x/day
- Bromelain: 2000-3000 MCU 3x/day away from food
- CoQ₁₀: 150-300 mg/day
- EPO/BCO/Borage seed oil (GLA): 300-600 mg
- Fish Oil: about 10g per day to equal at least 3g EPA
- Ginger: standardized for 20% gingerol and shogoal, 100-200 mg 3x/day
- Glucosamine and Chondroitin Sulfate: 1500 mg and 1200 mg respectively
- Magnesium citrate: 2:1 ratio with Calcium
- Multivitamin/Mineral (without Fe unless menstruating or anemic)
- Probiotics: 1 – 2 pills per day (providing at least several billion live active cultures)
- Pycnogenol (OPC): 150 mg 2x/day
- Quercetin: 400 mg 20 minutes before meals 3x/day
- Turmeric (standardized at 90 to 95% curcumin): 250-500 mg 3x/day between meals
- Vitamin D: 4000 IU/day maintenance

Supplement considerations: capsules, no additives/preservatives/colors/excipients (inert dilutents). Herbs should be standardized extracts.
Dr. Geoff’s Pancakes*

Flourless Honey-Almond Muffins*

Happy Hippie*: quinoa or oats w/ toasted walnuts, blueberries, ground flax & local honey

Huevos Rancheros: heat a corn tortilla and spread vegetarian refried beans on it. Add a sunny side-up or scrambled egg and top with sliced avocado and mango or tomato salsa

Organic, plain yogurt with fresh berries and toasted nuts (almonds, walnuts, pecans, etc.). Add local honey for desired sweetness.

Steel cut oats mixed with almond butter or nuts, diced apples or pears (cook them into the oats) and cinnamon

Super Smoothie*

Veggie scramble with eggs, onions, mushrooms and spinach, and a side of turkey bacon or roasted sweet potatoes
Anti-Inflammatory Meals & Snacks

Lunches

- Bean & Kale Scramble*
- Brown rice & beans with fresh Cranberry-Avocado Salsa*
- Garlic Chickpeas and Greens*
- Lentil and Green Olive Salad*
- Mango & Black Bean Salad* with corn tortillas (preferably sprouted corn)
- Tuna salad, chicken salad or egg salad on mixed greens with diced avocado (and any other colorful veggies desired) and homemade dressing*
- Leftovers!
Anti-Inflammatory Meals & Snacks

**Snacks**

- Avocado with fresh lime juice and sea salt
- Berries (or any fresh fruit) + a handful of nuts or plain yogurt
- Celery or apples with peanut butter or almond butter
- Deli turkey (antibiotic-, hormone-, and nitrate-free) wrapped around apple slices
- Edamame
- Hardboiled egg and carrots or snap peas
- “Mary’s Gone Crackers” with wild smoked salmon
- Peanut Butter Balls*
- Pumpkin seeds (toasted & salted, if desired)
- Tomatoes, minced garlic, extra virgin olive oil, balsamic vinegar and chopped basil (fresh mozzarella cheese, optional)
- Tortilla chips and guacamole* (see recipes “Tasty Tortilla Chips” and “Josh’s Guacamole”)
- Trail mix with almonds, cashews, walnuts and dark chocolate chips or dried cranberries
- Veggies (carrots, jicama, celery) with hummus
Anti-Inflammatory Meals & Snacks

Dinners

- ¼ of plate: Choose a protein (preferably organic and w/o hormones or antibiotics) - fish, chicken/turkey w/o skin/fat, grass-fed meat, shellfish, beans/lentils or tempeh/tofu
- ¼ of plate: Choose a starch (yams, sweet potatoes, squash, peas, corn, quinoa, brown rice, etc.)
- ½ of plate or more: Choose a variety of non-starchy veggies.

Specific dinner ideas:

*Hearty Soups and Stews*
- Chicken & Black Bean Chili*
- Ethiopian-Style Chickpea Stew*
- Olga’s Vegetable Soup*
- Tuscan White Bean Soup* with quinoa or brown rice

*The Main Event: Protein*
- Cod in Tomato Sauce* (the name is bland, but the fish is phenomenally flavorful!)
- Grilled Paprika Chicken*
- Salmon Cakes*
Anti-Inflammatory Meals & Snacks

Dinners
- Beet and Kale Salad*
- Herbed Sweet Potatoes*
- Mohamed’s Saucy Dip (may be used as a topping or dip for almost anything!)*
- Roasted Kale* and Sauteed Kale Stems*

Desserts:
- Chocolate Bark*
- Fabulous Fruit Crisp*
- No-Bake Chocolate Brownies*
- Raw Chocolate Macaroons*
Anti-inflammatory Recipes

The Anti-Inflammatory Meal & Snack List and all associated recipes are available to download for two weeks after the conference.

Just visit www.nutritionhousecalls.com and click “Recipes”.
References for Anti-Inflammatory Food Slides

Other References

- www.vitasearch.com
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