Nutritional Approaches to Rheumatologic Conditions

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Medical Director, AZ Center for Integrative Medicine
Asst Professor of Medicine, University of Arizona COM
Outline

- Introduction
- Fish Oil
- Supplements & Botanicals
  - Glucosamine
  - Turmeric
  - Licorice root
- Whole Diets
Why Should I Care?
Laverne M.

- 78 yo obese woman; retired RN
- Severe bilateral knee osteoarthritis; wheelchair-bound
- Also dealing with atrial fibrillation (on warfarin); CHF; chronic renal insufficiency. Hx of severe GI bleed secondary to NSAID-induced gastritis
- ALL: morphine (N,V)
Anne R.

- 43 yo woman with RA (hands, feet, hips)
- PMH: Breast CA (s/p lumpectomy, XRT)
- Has used MTX, SSZ, leflunomide in the past w/o much success. Using NSAIDs, w/ opioids for rescue
- Prefers to avoid high dose corticosteroids
- Not a candidate for biological therapy
When drugs are not optimal

- Allergies or adverse events
- Increased risk of concomitant disease
- Cost prohibitive
- Drug interactions
- Patient preference
It’s not just my opinion...

“Most interventions currently prescribed for knee OA involve either drugs or surgery, and options for conservative care of patients with knee OA are often overlooked.”
“In addition, because of the known toxicity and adverse event profiles of such therapies as NSAIDs, cyclooxygenase (COX)-2 inhibitors, and total joint replacement, primary care for OA should place greater emphasis on nonpharmacologic treatments.”

American College of Physicians Statement on Osteoarthritis (2007)
AHA Scientific Statement

Use of Nonsteroidal Antiinflammatory Drugs
An Update for Clinicians
A Scientific Statement From the American Heart Association

Elliott M. Antman, MD, FAHA; Joel S. Bennett, MD; Alan Daugherty, PhD, FAHA;
Curt Furberg, MD, PhD, FAHA; Harold Roberts, MD, FAHA; Kathryn A. Taubert, PhD, FAHA

Gastrointestinal risk

Bleeding, ulcer complications
Discontinuation

Degree of selectivity

COX-2

COX-1

Etoicoxib
Rofecoxib
Celecoxib
Diclofenac
Ibuprofen
Naproxen
Figure 1. Comparison of effects of different selective COX-2 inhibitors vs placebo on myocardial infarction. Event numbers and person-years of exposure, with corresponding mean annual event rates in parentheses, are presented for patients allocated to selective COX-2 inhibitor or placebo. Event rate ratios for pooled data with 95% CIs are indicated by a diamond; rate ratios for individual selective COX-2 inhibitors, with 99% CIs, are indicated by a square and horizontal line. Diamonds to the right of the solid line indicate hazard with a selective COX-2 inhibitor compared with placebo. As noted, there was a significant increase in the rate ratio for myocardial infarction with COX-2 inhibitors compared with placebo. Similar analyses (data not shown) include rate ratios of 1.42 (1.13 to 1.78; \( P=0.003 \)) for vascular events, 1.02 (0.71 to 1.47; \( P=0.9 \)) for stroke, and 1.49 (0.97 to 2.29; \( P=0.07 \)) for vascular death with COX-2 inhibitors compared with placebo. Modified and reproduced from Kearney et al,\(^2\) with permission from the BMJ Publishing Group.
Celecoxib capsules

Cardiovascular Risk

- CELEBREX may cause an increased risk of serious cardiovascular thrombotic events, myocardial infarction, and stroke, which can be fatal. All NSAIDs may have a similar risk. This risk may increase with duration of use. Patients with cardiovascular disease or risk factors for cardiovascular disease may be at greater risk. (See WARNINGS and CLINICAL TRIALS).

- CELEBREX is contraindicated for the treatment of peri-operative pain in the setting of coronary artery bypass graft (CABG) surgery (see WARNINGS).

Gastrointestinal Risk

- NSAIDs, including CELEBREX, cause an increased risk of serious gastrointestinal adverse events including inflammation, bleeding, ulceration, and perforation of the stomach or intestines, which can be fatal. These events can occur at any time during use and without warning symptoms. Elderly patients are at greater risk for serious gastrointestinal events (See WARNINGS).
OK...so I see a value in considering non-pharmacological therapies, but...

...non-pharmacological therapies lack the “gold standard” studies necessary for me to make good clinical choices.
A Philosophy
The greater the potential a treatment has to cause harm, the stricter the standards of evidence it should be held to, in terms of efficacy.
Some Therapeutic Options...
Fish Oil
Documented Benefits of Fish Oil

• Protection against sudden cardiac death after MI
• Reduction in plasma triglycerides
• Modest reduction in blood pressure
• May counter effects of atherogenic diet (in lab rats)

Fish Oil and Arthritis

- Over 13 randomized and controlled studies that show some clinical symptom improvement using fish oil
- Paucity of OA studies; mainly RA
- Both EPA and DHA have shown benefits (mainly EPA)
- Tricky to choose appropriate placebos
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<th>Outcome</th>
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Lessons from the RA Studies

- All patients examined were in late disease (>10 yrs)
- No studies showed detrimental systemic effects
- Effects generally delayed 2-3 months
- Similar to DMARDs; in contrast to NSAIDs
- Faster response w/ 90 mg/kg/d relative to 45 mg/kg/day (EPA:DHA of 3:2)
- AI effects at doses 2.6-7.1 g/day (none at 1g/day)
Inflammation

- Provoked response to insult
- Chemicals, trauma, infection, allergens, autoantigens
- Purpose: to destroy, dilute, or wall off the provocateur
- A protective response, but can be harmful to the host
- Alarm bells: inflammatory mediators and cytokines
rubor, calor: increased blood flow; vasodilation
tumor: increased vascular permeability (leakage of plasma proteins)
dolor: nerve ending stimulation (bradykinin)
Arachidonic acid (AA; 20:4 n-6)

Eicosapentaenoic acid (EPA; 20:5 n-3)

Docosahexaenoic acid (DHA; 22:5 n-3)
Fats and fatty acids

- Saturated fats
  - Animal fats, butter, lard

- Unsaturated fats
  - Polyunsaturated fats
    - Omega 3 fatty acids
      - Eicosapentanoic acid: fish, shellfish
      - Docosahexanoic acid: fish, shellfish
      - α-linolenic acid: flaxseed, soybean, walnut, rapeseed oils
    - Omega 6 fatty acids
      - Corn oil
      - Safflower oil
      - Sunflower oil
    - Omega 9 fatty acids
      - Olive oil
      - Avocados
      - Peanuts
      - Almonds
Omega 6
Linoleic acid
→
Arachidonic acid

Omega 3
α-linolenic acid
→
Eicosapentanoic acid

Cyclo-oxygenase

Lipoxygenase

Omega 6 derived eicosanoids
2 series prostanoids
TXA₂, PGE₂, PGI₂
4 series leukotrienes
LTB₄, LTC₄, LTE₄
Pro-inflammatory

Omega 3 derived eicosanoids
3 series prostanoids
TXA₃, PGE₃, PGI₃
5 series leukotrienes
LTB₅, LTC₅, LTE₅
Anti-inflammatory
Summary: Effects of Omega-3 FA

- Decreased production of arachidonic acid-derived mediators (PGE$_2$, etc.)
- Production of EPA-derived eicosanoids with low inflammatory potential
- Production of anti-inflammatory E- and D-series resolvins
- Decreased production of inflammatory cytokines; NF-kB inhibition (TNF-α, IL-1)
- Decreased T cell reactivity; Deceased production of Th1-type cytokines (IFN-γ, etc.)
- Decreased adhesin production in leukocytes

Calder PC (2010) in Integrative Rheumatology (Horwitz, Muller, eds), Oxford University Press, 23-46
Membrane Phospholipids

Phospholipase A2

Arachidonic Acid

Cyclooxygenase

5-Lipoxygenase

Prostaglandins
Thromboxanes

Leukotrienes

$\text{LTB}_4$

$\text{LTC}_4, \text{LTD}_4, \text{LTE}_4$
Addition of 3.2 g EPA /2.2 g DHA daily to normal diet

The omega-3 supplements alter the pro-inflammatory fatty acid composition of the cell membranes
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<th>Study</th>
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<td>Lee, et al.</td>
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<tr>
<td>6 wk</td>
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<tr>
<td>3.2 EPA+2.2 DHA</td>
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Figure 3. Schema of Potential Dose Responses and Time Courses for Altering Clinical Events of Physiologic Effects of Fish or Fish Oil Intake

- Clinical Effect
  - Antiarrhythmia: Weeks
  - Triglyceride-Lowering: Months to Years
  - Heart Rate-Lowering: Months
  - BP-Lowering: Months to Years
  - Antithrombosis: Weeks

Mozaffarian D, Rimm EB. JAMA. 2006;296(15):1885-1899
Dosing of n-3 PUFA in RA Trials

EPA:  2.3 +/- 0.9 grams/d
DHA:  1.4 +/- 0.6 grams/d

A quick word about Krill Oil...

- zooplankton, 1-5 cm long
- makes up the largest animal biomass on the planet.
- omega-3 as phospholipid
- esterified astaxanthin
One study of krill oil & RA

- DBA/1 mouse model (2-step collagen-induced)
- Ad libitum access to food: krill, fish oil, control chow (standardized to EPA+DHA content)
- Used clinical scoring system, histopathology
- Both fish and krill oil reduced scores vs control

Botanicals / Supplements

- Glucosamine/chondroitin
- Turmeric (curcuminoids)
- Licorice Root
Glucosamine/Chondroitin

- Glucosamine
  - involved in proteoglycan synthesis
  - clinical trial dose: 1500 mg/d
  - from shellfish (caution w/ allergies)

- Chondroitin sulfate
  - structural component of cartilage
  - clinical trial dose: 1200 mg/d
  - from animal cartilage (shark, cow)
Glucosamine/Chondroitin: Data

- Two meta-analyses found chondroitin superior to placebo in relieving pain; well-tolerated.

- 3-year RDBPC glucosamine trial: 212 pts; 1500 mg daily.
  - Improvements in symptoms (+12% vs -10%)
  - Preservation of joint space relative to placebo (0.06 mm vs 0.31 mm narrowing)

McAlindon TE, et al. JAMA. 2000;283:1469-75
“The long-term combined structure-modifying and symptom-modifying effects of gluosamine sulfate suggest that it could be a disease modifying agent in osteoarthritis.”

The Glucosamine/Chondroitin Arthritis Intervention Trial (GAIT)

- 1583 people w/ knee OA; 24 wk RDBPC study
- 80% mild pain / 20% moderate-severe pain
- 4 arms (plus placebo):
  - Glucosamine alone (500 mg TID)
  - Chondroitin alone (400 mg TID)
  - Glucosamine/Chondroitin (as above)
  - Celecoxib alone (200 mg QD)

Primary outcome measure:

Does glucosamine and chondroitin sulfate, used separately or in combination, reduce pain in participants with knee osteoarthritis?
Cost?
$12.5$ million
Press Release

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bboyd-flynn@rheumatology.org

**Embargoed For Release at 5:30 pm PT, Sunday Nov. 13, 2005.**

**Arthritis News.**

**GLUCOSAMINE AND CHONDROITIN SULFATE MAY BE USEFUL FOR PATIENTS WITH MODERATE TO SEVERE PAIN FROM KNEE OSTEOARTHRITIS**

SAN DIEGO, CALIFORNIA - Glucosamine and chondroitin sulfate may be an effective combination in reducing pain associated with osteoarthritis of the knee, according to research presented this week at the American College of Rheumatology Annual Scientific Meeting in San Diego, California.
ACR: No Clear Benefit for Painful Knees in Big Glucosamine-Chondroitin Study

By Lynne Peterson, Special Correspondent, MedPage Today
Reviewed by Robert Jasmer, MD; Assistant Professor of Medicine, University of California, San Francisco
November 21, 2005

MedPage Today Action Points

• Be aware that an NIH-sponsored trial of glucosamine/chondroitin for patients with osteoarthritis demonstrated no clear benefit.
Glucosamine and chondroitin offer pain relief for knee osteoarthritis

What happened. Glucosamine and chondroitin sulfate may be an effective combination in reducing moderate to severe knee pain associated with osteoarthritis, according to research presented this week at the American College of Rheumatology Annual Scientific Meeting in San Diego. The supplements do not appear to offer substantial relief, however, for those with mild osteoarthritis knee pain after 24 weeks of treatment.
Alternative Remedies Fail Government Tests
By LINDSEY TANNER AP Medical Writer
February 28, 2006 | CHICAGO — For years, millions of Americans have spent billions of dollars on alternative remedies with unproved effects. Now, rigorous science is starting to test those treatments and mostly finds them lacking.

The New York Times
February 23, 2006
Supplements Fail to Stop Arthritis Pain, Study Says
By GINAKOLATA

Study: Arthritis pills have placebo effect
Popular supplements unproved
By Miki Chang
The Associated Press
Two best-selling supplements used by millions of Americans are of little help to most people with mild arthritis, concludes a large government study that is part of an effort to scrutinize unregulated health remedies.
The GAIT Trial: Results

- 64% who took 1500 mg a day of glucosamine had reduced pain
- 65% who took 1200 mg a day of chondroitin had reduced pain
- 67% who took 1500 mg glucosamine and 1200 mg a day chondroitin had reduced pain
- 70% who took 200 mg a day of Celebrex had reduced pain
- 60% who took the placebo had reduced pain
The GAIT Trial: Results

- Improvement in subset with moderate-severe pain
  - 79% glucosamine/chondroitin (p=0.002)
  - 69% celecoxib
  - 54% placebo

Although 67% of participants who took the combined treatment had reduced pain, it was deemed ineffective.

(pregnant pause)
Turmeric

- Gives mustard its yellow color; in curries
- One of the most potent natural anti-inflammatories
- Popular component of many OTC nutraceuticals
- Subject of several recent studies in autoimmunity
The UA Turmeric Study

- Does turmeric function as an anti-arthritic agent? If so, what is the mechanism?

- Used home-made turmeric vs commercial products (whole rhizome, essential oils, oil-free extract w/ 3 major curcuminoids)

- Used rats in a streptococcal cell wall-induced (SCW) model of rheumatoid arthritis

The Results

- First documentation of a curcumin-containing extract tested *in vivo*, for anti-arthritic efficacy.
- The curcuminoid-enriched compound completely inhibited the onset of rheumatoid arthritis.
- Mechanism: curcuminoids inhibited activation of NF-kB, a pro-inflammatory transcription factor.

Daily pre-treatment of rats (4d) with IP turmeric

Dose response curve for turmeric in acute and chronic phase

What if we wait until the RA has begun?
Start curcuminoids at d3 post-SCW
Licorice Root

- Active components (glycyrrhetinic acid, glycyrrhizin, carbenoxalane) potently inhibit cortisol metabolism
- Used as treatment for Addison’s disease until 1950’s
- Steroid-sparing activity (inhibits 11β-HSD)

Glycyrrhiza glabra

Diagram: Hydrocortisone → Cortisone (inhibited by 11β-HSD)
EXTRACT OF LICORICE FOR THE TREATMENT OF ADDISON’S DISEASE*

J. Groen, M.D.,† H. Pelser, M.D.,‡ A. F. Willebrands, Ph.D.,§ and C. E. Kamminga, Ph.D.¶

AMSTERDAM, THE NETHERLANDS

Extract of licorice has been in use in Western Europe for many years as an adjuvant for disguising the taste of other drugs in medical mixtures. It is also used in various forms as a sweet effect was doubtful. Apart from this curative action on ulcer of the stomach (which may be due to the presence of a spasmolytic principle), Revers noticed that about 20 per cent of his cases developed

---

A Role for Licorice in Anti-inflammatory Therapy?

- Useful agent when considering corticosteroids, but avoiding a burst (steroid-sparing)
- Helps facilitate completion of a corticosteroid taper
- Dose of powdered root is 3-6 grams a day, or the solid (dry powdered) extract: 250-500 mg a day
- Mineralocorticoid effects may be similar to exogenous corticosteroids (hypokalemia, elevated blood pressure, etc). Monitor BP and electrolytes.

Whole Diets
The Nightshade Diet

- Attributed to Norman Childers, PhD (American horticulturalist)
- Avoid eating members of the nightshade family, Solanaceae, (incl. potatoes, eggplant, peppers, tomatoes).
- It has been estimated that for 1-2% of patients with RA, nightshades can lead to arthritis flares.
- Theory: eating nightshades results in "a buildup of cholinesterase inhibiting glycoalkaloids and steroids…and may cause inflammation, muscle spasms, pain, and stiffness."
Learn how one plant can be the source of endless health problems. Eliminate this plant and eliminate pain.

Michael Fowler
Little or “no food” diets
Fasting

- Decreases many immune parameters, including autoimmunity
- Works best for flares of GI & non-GI conditions
- Probably evolutionary mechanism
Problems with Fasting

- Long-term compliance incompatible with life
- Following fast, anti-rheumatic effect typically wears off, no matter what maintenance diet is chosen
- Safety issues (renal, cardiac, etc)
How we do it: Juice Fast

• Drink only juice from fresh, organically grown fruits and vegetables.

• Drink at least four eight to 12 ounce glasses of juice plus plenty of pure water (at least four eight ounce glasses per day) and, if you like, unsweetened herb tea.

• Prepare the juice yourself (use juicer). Drink homemade juice within an hour after making it – otherwise, its nutritional value will deteriorate. If you can't make juice yourself, buy natural juices that don't contain added sugar.
How we do it: Juice Fast

• To keep yourself regular while on a juice fast, take powdered psyllium. Mix a tablespoon in a big glass of water, drink it all and then drink a glass of pure water.

• When the time comes to break your fast, eat lightly and slowly - some whole fruit, perhaps. A heavy, rich meal to celebrate the end of your fast is likely to make you sick.

• You can safely do a juice fast for one to three days, with consent of a health care practitioner. Do not fast if diabetic, pregnant, or nursing. Be sure to fast during times when you know your activity will not be as strenuous as usual.
Caloric Restriction

- In everything from yeast to primates, caloric restriction can extend lifespan by as much as one-third.
- Related to activation of SIRT3 and SIRT4 gene products in mitochondria.
- Also shown to impact autoimmune conditions.

The NZB/W Mouse

• Animal model for SLE and lupus nephritis
• Develops immune complex-mediated glomerulonephritis (capillary basement membranes)
• Autoantibodies also develop (anti-DNA)
• Have been used in CR studies for many yrs
Delayed Autoimmune Pathology in CR NZB/W Mice

20 KCal/d

10 KCal/d

**Fig. 1.** (A and B) Histologic sections. (A) Typical glomerulus from a B/W mouse fed 20 cal per day. The glomerular tufts show proliferation and sclerosis. Note wire loop lesions similar to those seen in human lupus. (Hematoxylin and eosin; ×200.) (B) Typical glomerulus from mouse fed 10 cal per day. Note the well-preserved glomerular architecture and the absence of sclerosis, wire loop lesions, or evidence of proliferation. Minimal increase of mesangial cells is the only abnormality present. (Hematoxylin and eosin; ×250.) (C and D) Immunofluorescence microscopy. (C) Glomerulus of 10-month-old 20-cal per day B/W mouse stained with fluorescent antiserum specific for IgG. Note irregular granular deposits of IgG lining cell capillaries of the glomerulus. Every glomerulus of the kidneys of these older B/W hybrids showed these characteristics (×500.) (D) Glomerulus of 10-month-old B/W mouse fed 10 cal per day. Note that glomerular capillaries are completely free of deposits of IgG. The only IgG demonstrable was present in the mesangium of the glomerular tuft. (×650.)
Elemental Diets

- Amino acids (no whole proteins)
- mono/di-saccharides
- medium/long-chain triglycerides
- vitamins and trace elements
We know that it works in Crohn's Disease...

Elemental Diets in Rheumatoid Arthritis

- 30 pts with active RA given 2 weeks of elemental diet or oral prednisolone (15 mg/d)
- Assessed clinical symptoms and objective lab measurements
- Symptomatic improvement seen in 78% of diet therapy group versus 78% of corticosteroid group
- Elemental diet clinically as useful as a low dose steroid course

early morning stiffness

visual analog (pain)

joint tenderness

swollen joints

But after 2 wks, inflammatory markers were unaffected...
Vegetarian Diets: The Oslo Study

- 53 total patients
- 7-10d fast, followed by a gluten-free, vegan diet for 3.5 mo, then lactovegetarian for 8.5 mo
- Diet group had changes in many objective and subjective categories; persisted for the year

The Oslo Study: Details

- 7-10d fast: herbal teas; garlic; vegetable broth; decocted potatoes; carrot, beet, and celery juices
- Vegan diet: same veggies as above (in whole food form), plus new food introduced q2 days. No dairy, gluten, meat, fish, eggs, refined sugar, citrus.
- Basic diet: allowed milk, dairy, gluten
- Caveat: No compliance monitoring

% patients showing improvement with diet changes

Why was the vegetarian approach successful?

- Psychobiological (placebo)
- Weight loss (decreased energy intake)
- Food allergies
- Eicosanoid precursors
- Fecal microflora
The Mediterranean Diet

High in: whole grains, veggies, legumes, fish, nuts, fruits, olive oil...
Mediterranean Diet: Benefits

• Increased overall survival
• Primary/secondary CAD prevention
• Decreases in inflammatory markers
Mediterranean Diet in Pts w/ RA

- 12 week study
- 56 pts with RA for at least 2 yrs
- Canola-based margarine provided to pts
- Lunch & dinner in hospital cafeteria x 3 wks
- Subtle decreases in: DAS, HAQ, SF36
- NSAID use: unchanged

Figure 1  Patient’s global assessment of disease activity by means of a VAS [0–100 mm] at baseline and weeks 3, 6, and 12. The results are presented in relative terms, where the baseline value is set to zero, as mean values with 95% confidence intervals.

Figure 2  Disease activity (DAS28 score) at baseline and at weeks 6 and 12. The results are presented in relative terms, where the baseline value is set to zero, as mean values with 95% confidence intervals.
Summary: Useful Interventions

- Fish oil: 1500 mg EPA daily; most conditions
- Turmeric: 1500 mg TID; most conditions
- Glucosamine/Chondroitin: OA
- Juice Fast: for refractory flares
- Elemental Diet: recovery from severe flares
- Licorice Root: gradually worsening sx; steroid sparing; pre-biologics (1-2 g TID)
- AI Diet: EVERYONE
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