The Cancer-Fighting Kitchen: Evidence-Based Nutrition Strategies

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Member, National Association of Nutrition Professionals
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Diet & Nutrition? For Cancer?

With our most aggressive weapons, we aren’t winning the War Against Cancer.

How could some wimpy foods have any effect?
<table>
<thead>
<tr>
<th>Cancer Type</th>
<th>Greater Survival Associated With...</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breast</td>
<td>≥5 servings veggies/fruit per day plus exercise 30 min, 6x/wk (45% more likely to survive 10 yrs)</td>
<td>Pierce JP: <em>J Clin Oncol.</em>, 2007 Jun 10;25(17): 2345-51.</td>
</tr>
</tbody>
</table>
Modulating Gene Expression
Nutrition Can Change Gene Expression

Flaxseed & Breast Cancer

STUDY: post-menopausal BrCa pts fed muffin with 25 grams (2 TBSP) flaxseed meal vs “placebo” muffin for 4-5 weeks. Compared tumor characteristics from biopsy and subsequent lumpectomy.

- 70% reduction in her2neu expression
- 34% reduction in ki-67 (rate of cancer cell division and growth)
- 30% increase in apoptosis (programmed cell death)

Men with prostate cancer not electing treatment (surgery, radiation, hormone therapy)

Gene expression compared after 3 months on diet

Expression of 500+ genes changed

Oncogenes were down-regulated!

Cancer’s “Master Switch”


**TRIGGERS:**
- carcinogens
- oxidation
- viral infection
- inflammation
- radiation
- chemotherapy
- stress

**ACTIVATES 400+ genes involved in tumor proliferation, survival, angiogenesis & invasion**
The reason to season?
To talk to your genes!

Spices Inhibit NFκB

- anise
- basil
- black pepper
- caraway
- cardamom
- chili pepper
- cinnamon
- clove
- coriander
- cumin
- fennel
- fenugreek
- flaxseed
- garlic
- ginger
- Holy basil
- lemongrass
- licorice
- mint
- mustard seed
- nutmeg
- oregano
- parsley
- rosemary
- saffron
- tamarind
- turmeric

Top 10 Foods to Modify Gene Expression

1. Spices (combinations: curry, chai)
2. Broccoli sprouts (sulforaphane)
3. Brassica veggies (isothiocyanates)
4. Dark leafy greens (folate)
5. Garlic, onions, leeks, chives, shallots
6. Parsley, celery, red pepper (luteolin)
7. Peanuts/boiled, red grapes/wine (resveratrol)
8. Red onions and capers (quercetin)
9. Green tea (theophylline, EGCG)
10. Fish, eggs, cheese, sunflower seeds, asparagus, almonds (B vitamins)
“Three times a day, day after day, we are eating foods that can influence our genes and help us fight cancer...”

—David Servan-Schreiber, MD
Insulin Resistance and Cancer
Blood Glucose & Cancer Survival

Survival in Mice with Injected Breast Cancer Cells

% surviving 70 days

<table>
<thead>
<tr>
<th>Approx. Blood Glucose (mg/dl)</th>
<th>% surviving</th>
</tr>
</thead>
<tbody>
<tr>
<td>60</td>
<td>3.7%</td>
</tr>
<tr>
<td>88</td>
<td>4.7%</td>
</tr>
<tr>
<td>108</td>
<td>5.4%</td>
</tr>
</tbody>
</table>

Survival of Brain Tumor Patients

Survival in months

<table>
<thead>
<tr>
<th>Mean Blood Glucose Level (mg/dl)</th>
<th>Survival in months</th>
</tr>
</thead>
<tbody>
<tr>
<td>65-93</td>
<td>14.5 mo</td>
</tr>
<tr>
<td>94-137</td>
<td>9.1 mo</td>
</tr>
<tr>
<td>≥ 138</td>
<td>6.0 mo</td>
</tr>
</tbody>
</table>


Influence of Insulin Resistance

Cancer patients with insulin resistance have...

✦ **Recurrence** - 3-fold ↑ risk of recurrence in 5 yrs in BrCa pts • ↑ rates of recurrence & liver mets in colon cancer pts

✦ **Post-Op Complications** - ↑ rate of post-op complications (40 vs 11%) and longer hospital stay (11 vs 8 days)

✦ **Immune Suppression** - ↑ risk of infection in pts undergoing intensive chemotherapy

✦ **Estrogen** - increases circulating estrogen via ↑ aromatase activity & ↓ SHBG production


Cancer Promoting Effects of Insulin Resistance

- **↑ DNA Damage** leading to gene instability
- **Mitosis** stimulates damaged cells to divide and make daughter cells
- **Inhibits Apoptosis** (allows cancer cells to evade programmed cell death and survive indefinitely)
- **Stimulates Angiogenesis** - ↑ growth of new blood vessels to fuel tumor progression
- **Promotes Cell Migration** - invasion & metastasis

**Are you facing insulin resistance?**

<table>
<thead>
<tr>
<th></th>
<th><strong>Diagnostic Value</strong></th>
<th><strong>Optimal Range</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Waist-Hip Ratio</strong></td>
<td>women: &gt; 0.85, men: &gt;1.0</td>
<td>women: &lt; 0.8, men: &lt; 0.9</td>
</tr>
<tr>
<td><strong>Fasting Glucose</strong></td>
<td>&gt; 100-110 mg/dl</td>
<td>60-90 mg/dl</td>
</tr>
<tr>
<td><strong>A1c</strong></td>
<td>≥ 6.0%</td>
<td>4.6-5.2%</td>
</tr>
<tr>
<td><strong>Triglycerides</strong></td>
<td>&gt; 150 mg/dl</td>
<td>&lt; 110 mg/dl</td>
</tr>
<tr>
<td><strong>HDL cholesterol</strong></td>
<td>women: &lt; 40, men: &lt; 50</td>
<td>&gt; 50-55 mg/dl</td>
</tr>
<tr>
<td><strong>Blood pressure</strong></td>
<td>&gt; 135/85</td>
<td>≤ 120/80</td>
</tr>
<tr>
<td><strong>Uric Acid</strong></td>
<td>—</td>
<td>&lt; 5.5 mg/dl</td>
</tr>
</tbody>
</table>
Foods with High Glycemic Load

<table>
<thead>
<tr>
<th>Foods</th>
<th>Foods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bread, white</td>
<td>Chips</td>
</tr>
<tr>
<td>Bread, whole wheat</td>
<td>Sugar</td>
</tr>
<tr>
<td>Cereal</td>
<td>Honey</td>
</tr>
<tr>
<td>Oatmeal</td>
<td>Flour, white</td>
</tr>
<tr>
<td>Crackers</td>
<td>Flour, whole wheat</td>
</tr>
<tr>
<td>Muffins</td>
<td>Corn</td>
</tr>
<tr>
<td>Bagels</td>
<td>Cornmeal</td>
</tr>
<tr>
<td>Cookies</td>
<td>Pasta</td>
</tr>
<tr>
<td>Pancakes</td>
<td>Potatoes</td>
</tr>
<tr>
<td>Waffles</td>
<td>Potato chips</td>
</tr>
<tr>
<td>Soda pop</td>
<td>Pretzels</td>
</tr>
<tr>
<td>Fruit Juice</td>
<td>Rice, white</td>
</tr>
<tr>
<td>Dried fruits</td>
<td>Rice, brown</td>
</tr>
<tr>
<td>Candy</td>
<td>Fat-free foods</td>
</tr>
</tbody>
</table>

BEWARE! These wholesome-appearing foods may be problematic for you!

www.glycemicindex.com  
www.nutritiondata.com
## Low Glycemic Substitutions

<table>
<thead>
<tr>
<th>INSTEAD OF THIS...</th>
<th>TRY THIS...</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Food</strong> (1 cup portion)</td>
<td><strong>Glycemic Load</strong>*</td>
</tr>
<tr>
<td>White flour</td>
<td>76</td>
</tr>
<tr>
<td>Whole wheat flour</td>
<td>44</td>
</tr>
<tr>
<td>Corn, sweet yellow</td>
<td>35</td>
</tr>
<tr>
<td>Hamburger bun</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Brown rice</td>
<td>22</td>
</tr>
<tr>
<td>Pasta noodles</td>
<td>22</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Mashed Potatoes</td>
<td>16</td>
</tr>
</tbody>
</table>

*Glycemic Load ≥ 10 is HIGH!*
# Strategies to Address Insulin Resistance

<table>
<thead>
<tr>
<th>FACTOR</th>
<th>SMART STRATEGIES</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DIET</strong></td>
<td>• Limit starchy carbs: 1-3 servings/day</td>
</tr>
<tr>
<td></td>
<td>• Glycemic Load: &lt; 10/food, &lt; 50/day</td>
</tr>
<tr>
<td></td>
<td>• Avoid liquid calories</td>
</tr>
<tr>
<td></td>
<td>• Avoid evening snacking</td>
</tr>
<tr>
<td><strong>STRESS</strong></td>
<td>Stress reduction techniques</td>
</tr>
<tr>
<td></td>
<td>(meditation, yoga, tai chi, massage)</td>
</tr>
<tr>
<td><strong>LOSS OF MUSCLE MASS</strong></td>
<td>• Weight-bearing exercise</td>
</tr>
<tr>
<td></td>
<td>• Adequate protein intake</td>
</tr>
<tr>
<td><strong>NUTRIENT DEFICIENCIES</strong></td>
<td>• Vitamin D</td>
</tr>
<tr>
<td></td>
<td>• CLA</td>
</tr>
<tr>
<td></td>
<td>• Chromium</td>
</tr>
<tr>
<td></td>
<td>• Vanadium</td>
</tr>
<tr>
<td></td>
<td>• Magnesium</td>
</tr>
<tr>
<td></td>
<td>• Carnitine</td>
</tr>
<tr>
<td></td>
<td>• Zinc</td>
</tr>
<tr>
<td></td>
<td>• Biotin</td>
</tr>
</tbody>
</table>

Top 10 Foods to Aid Glycemic Control

Cinnamon
Berries: blueberries, goji, blk currant
Chamomile tea
Allium family: garlic, onions, leeks, chives
Parsley
Avocado
Olive oil
Flaxseed meal / Oat bran (soluble fiber)
Lemon
Nopal (prickly pear cactus)

Inflammation and Cancer
Inflammation: Other Findings

Patients with ↑ inflammation experience:

✧ **Toxicity of Chemotherapy** - More severe low blood counts during chemotherapy

✧ **Cachexia (wasting syndrome)** - Lower appetite, ↑ muscle wasting and ↑ weight loss

✧ **Greater Fatigue** - ↑ fatigue and poorer quality of life


Dietary Fats & Inflammation

**OMEGA-6 FATS**
- Commercially-raised meat, poultry, dairy, eggs
- Most nuts & seeds
- Vegetable oils—corn, safflower, soy, grapeseed (not olive oil)

**OMEGA-3 FATS**
- Grass-fed/pastured meat, poultry, dairy, eggs
- Cold-water fish
- Black walnuts, flaxseeds
- Oils of flax, hemp and canola (not advisable)

**PRO-INFLAMMATORY Compound**
- Foster tumor growth & progression
- Promote angiogenesis
- Suppress immune function

**ANTI-INFLAMMATORY Compounds**
- Inhibit tumor growth & progression
- Complement radiation & chemo
- Anti-angiogenesis

\[
\omega-6 / \omega-3 \\
\uparrow \text{insulin}
\]

\[
\omega-3 / \omega-6 \\
\downarrow \text{insulin}
\]
Diet to Address Inflammation

- ↑ Intake of fruits & vegetables (8+ servings/day)
- Ratio of ω-6:3 fats about 1:1 to 3:1
  - ↓ Vegetable oils, margarine, commercially-raised meat, poultry, dairy, eggs
  - ↑ Cold-water fish, organic grass-fed meat, poultry, dairy and omega-3 rich eggs, walnuts, hemp, chia and flaxseed meal, leafy greens
- Low glycemic diet (↓ insulin-driven inflammation)

Find sources for grass-fed foods at [www.eatwild.com](http://www.eatwild.com)


Top 10 Foods to Quench Inflammation

Spices (esp. curry, ginger, garlic, parsley)
Wild, cold-water fish
Grass-fed (pastured) meat, dairy, eggs
Hot peppers
Olive oil
Leafy green veggies (spinach, chard, kale)
Cruciferous vegetables
Pumpkin, butternut squash, yam, carrot
Dark chocolate (flavanols)
Berries (blueberries, cherries, raspberries)

TAKE HOME TIPS: Anticancer Diet in 5 Easy Steps

✧ Low glycemic
✧ High nutrient density
✧ Daily rainbow of phytonutrients
✧ Ample spices (NFκB reason to season)
✧ Improved omega-6:3 ratio
# Marrying Flavor and Nutrition

<table>
<thead>
<tr>
<th>Flavor Balancer</th>
<th>Culinary Job</th>
<th>Nutritional Job</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Aromatic</strong></td>
<td>garlic, onion, shallots, citrus zest, ginger, pepper, herbs &amp; spices</td>
<td>Provide depth of flavor and interest</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Modulate gene expression (antioxidant, anti-inflammatory, NFkB inhibitors)</td>
</tr>
<tr>
<td><strong>Fat</strong></td>
<td>olive oil, butter, coconut oil, sesame oil</td>
<td>Distribute flavors across the palate, add creaminess (rich mouth feel)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Required for absorption of phytonutrients (carotenoids), increases satiety</td>
</tr>
<tr>
<td><strong>Acid or Sour</strong></td>
<td>lemon, lime, vinegar, tamarind, sumac, ponzu, tomatoes, pickles, caneberries</td>
<td>Add “zing,” brighten flavors</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Increase absorption of minerals, stimulate digestion</td>
</tr>
<tr>
<td><strong>Salt</strong></td>
<td>kosher or sea salt, tamari or soy sauce, MSG-free bouillon (“Better than Bouillon” brand), fish sauce, nitrate-free bacon or ham</td>
<td>Bring out flavors, reduce blandness, move flavor to the front of the tongue (where it’s best perceived)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Improve appetite, balanced ratio with potassium essential for energy and cellular metabolism</td>
</tr>
<tr>
<td><strong>Sweet</strong></td>
<td>maple syrup, honey, agave, other low-glycemic sweeteners, apples, fruits, caramelized onions</td>
<td>Calm harsh, sour or spicy flavors, “round out” or harmonize the flavors</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Increase desire to eat and sense of pleasure. Provide sense of being nourished.</td>
</tr>
</tbody>
</table>
Clinical Findings

524 BrCa pts followed 5 yrs
↑ dietary intake soy associated with ↓ risk of recurrence in post-menopausal pts with ER+ BrCa


5,042 BrCa survivors, 20-75 yrs old, in China, followed 5 yrs
Soy food intake inversely associated with mortality and recurrence


1,954 BrCa survivors, followed 6 yrs
Postmenopausal women on tamoxifen, ~ 60% reduction in recurrence cf highest to the lowest isoflavone intake


FAQ: Is soy safe for patients with ER+ breast cancer?

✦ Not estrogen, rather SERM - in vivo competes with estrogen and xenoestrogens

✦ Modulates estrogen via many pathways - ↑ SHBG, ↓ circulating estrogen, ↑ 2:16-OH estrogen ratio

✦ Other effects - anti-angiogenesis, tyrosine kinase inhibition, promotes differentiation, induces apoptosis, impedes invasion and metastasis
FAQ: Do antioxidants interfere with cancer treatment?

Meta-Analysis

50 human clinical trials

n = 8,521 pts (>5,000 given antioxidants during treatment)

No evidence of interference

Enhanced cytotoxic efficacy of chemotherapy

Increased survival time


- **Antioxidants specificity** - RT hydroxyl radical quenched by vitamin C; lipid peroxidation quenched by vitamin E

- **Tissue specific bioaccumulation** - (fat vs water soluble), lycopene in liver/adrenal, breast/brain/prostate

- **Differential uptake in cancer cells** - ↑ intake in cancer cells, have pro-oxidant effect in ↑ amounts

- **↑ Oxidation = Gene instability** - ↑ oxidation may be culprit in development of more aggressive tumors

- **↑ Oxidation leads to ↓ cell proliferation** - but chemo targets rapidly dividing cells

- **Foods > supplements** - foods have much ↑ antioxidant effect (ORAC) than supplements!
FAQ: Is vegetarian or vegan the best anti-cancer diet?

<table>
<thead>
<tr>
<th>ADVANTAGES</th>
<th>CONCERNS</th>
<th>STRATEGIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Opportunity for high intakes of phytonutrients and antioxidants</td>
<td><strong>Increased Copper</strong> - low zinc in diet (vegetarian food sources of zinc are also rich in copper)</td>
<td>Nuts/seeds with Zn:Cu Ratio $\geq 6:1$ (pumpkin, sunflower, macadamia, sesame seeds). Zinc supplement as needed.</td>
</tr>
<tr>
<td>Avoids nitrates in processed meats and <em>heterocyclic amines</em> in charred meats</td>
<td><strong>Insulin Resistance</strong> - may over-emphasize high glycemic load foods</td>
<td>Follow low glycemic load diet</td>
</tr>
<tr>
<td>Reduces exposure to toxins which bioaccumulate in animal foods (top of food chain)</td>
<td><strong>Low CLA</strong> - avoidance of food sources of conjugated linoleic acid (CLA)</td>
<td>CLA supplement (9-cis,11-trans) if avoiding dairy or eating only non- or low-fat dairy. Sunflower seeds have CLA, but are 65% lower in 9-cis,11-trans isomer.</td>
</tr>
<tr>
<td></td>
<td><strong>Low Omega-3s</strong> - walnuts, flaxseed/hemp seed oils have less conversion of EPA &amp; lack DHA</td>
<td>Include cold-water fish in diet, or purified fish oil supplement (less toxin exposure)</td>
</tr>
<tr>
<td></td>
<td><strong>Low Vitamin A</strong> - beta carotene not converted to retinol in states of insulin resistance or low thyroid</td>
<td>Ensure adequate thyroid function; address insulin resistance</td>
</tr>
</tbody>
</table>