Regenerating Human Health: The Soil Connection

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8th Annual
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My previous worksite: Cucumber Gulch - a 77-acre wetlands and wildlife preserve in Breckenridge, CO

Story of an “Eco-Nutritionist”?

• Ecological Work – started 2006 in Denver

• Nutrition Career – 2012 relocated to east coast

• Interest in “Regenerative Agriculture” developed as a result of my clinical work

• Fred Provenza once said the doctors of the future will be “Ecological Doctors”
  • And perhaps even “Ecological Nutritionists”? 😊
Regenerative Farmers & Ranchers as Healers

Eating is an agricultural act.

(Wendell Berry)

*Agriculture is a health-related act*

(Sara Keough)

Producers should be “selling nutrition, not commodities”

(Gabe Brown)

Regenerating Human Health Must Start with Regenerating Our Farms & Ranches!

*Regeneration is rebuilding and rejuvenating life on earth*

How Healthy Farming Practices Can Regenerate Human Health

1. Nutrient Dense Food
   - Vitamins & Minerals
   - Phytonutrients
   - Improved Omega 6/3 Fatty Acid Ratio

2. Healthy Human Microbiome

3. Toxin-free Food

*All of these are dependent on nutrient-rich SOIL and soil BIOLOGY*
What is “Nutrient Density” & Why Does it Matter?

• **NUTRIENT DENSITY**– classically defined as the concentration of nutrients per calorie of food

• Which Nutrients define “Nutrient Density”?
  • **MACRONUTRIENTS** – fats, carbohydrates and proteins
  • **MICRONUTRIENTS** – vitamins & minerals

• But **PHYTONUTRIENTS** are not often included – health-enhancing plant compounds
What the Research Says about Nutrient Density: Maillot Study

• Researchers measured 23 different nutrients in a WIDE variety of foods:
  • Vitamins
  • Minerals
  • Protein
  • Fiber
  • and essential fatty acids

• Which foods do you think TOPS the List for Nutrient Density?

Great study! But it still has limitations

• QUALITY of foods were not evaluated

• “Nutritional Reductionism” – still missing many nutrients

• PHYTOCHEMICALS not measured
  • Terpenes, alkaloids, antioxidants, flavonoids, lignans, phenols, etc.

• NDS lower for high calorie foods (e.g. dairy)

• Bioavailability/absorbability of nutrients not considered
  • i.e. Iron from animal foods better absorbed than iron from plant foods

• FRESHNESS – how local and fresh were these foods?

• If the above factors had been considered in the Maillot study then it’s possible some foods may have ranked even higher!
What About “Phytochemical Richness” of Meat & Dairy?

**Health-Promoting Phytonutrients Are Higher in Grass-Fed Meat and Milk**

**Fred Provenza**, **Stephan Van Vliet**

**PHOTOCHEMICALS IN MEAT AND MILK**

*Tropolones, *-santonin, *-cryptoxanthin, *-neoxanthin*—are a large and diverse class of phytochemicals that contribute to the antioxidant, anti-inflammatory, anti-viral, anti-aging, and anti-carcinogenic properties. (Zhang et al., 2016; Zhang, 2017.)*

**Terpenes**—long-chain hydrocarbons that occur in many plant tissues and foods are directly related to the terpenoid composition of the cattle’s diet. (Cavallaro et al., 2014; Ragsdale et al., 2006; Provan et al., 2003; Potrykus et al., 2015). Animals grazing more Botanically diverse pastures accumulate higher amounts of a wide variety of terpenoids (and other phytochemicals) in their meat and milk compared to animals grazing on diet (i.e., mono-cropped) pastures, while concentrations of phytocides are further reduced—often remain undetected—in the meat and milk of animals fed grain-based diets in feedlots (Figure 3).

*Milk obtained from dairy cows grazing described forages contained higher concentrations of 4′-(3,4′-dihydroxyphenyl)-3″-methoxybenzylamine (terpenoid) compared to control meals obtained from the same herd concentrations (Kris-Etherton et al., 2005). Similarly, Agnew et al. (2012) found that terpenoids—such as *-cryptoxanthin, *-neoxanthin, *-tropolone, *-santonin, *-cryptoxanthin, *-neoxanthin*—were higher in milk from pasture-raised cattle with access to more diverse plant material compared to animals fed grain-based diets. (Kris-Etherton et al., 2009) found that (1′,2′,3′,4′-tetrahydro-2′-propyl-5′-propyl-3′,7′-dimethoxycarotenoids) and (E)-2′,4′-dihydroxy-7′-dialdehyde-5′-propyl at concentrations of 0.16 (tropolones, *-terpenoids, *-santonin, *-neoxanthin, *-cryptoxanthin, *-neoxanthin*—were higher in milk from pasture-raised cattle with access to more diverse plant material compared to animals fed grain-based diets. (Kris-Etherton et al., 2009) found that (1′,2′,3′,4′-tetrahydro-2′-propyl-5′-propyl-3′,7′-dimethoxycarotenoids) and (E)-2′,4′-dihydroxy-7′-dialdehyde-5′-propyl at concentrations of 0.16.

**Phenols**

Phenols in plants exist strongly in vivo antioxidant and anti-inflammatory effects in both animals (Vartanian et al., 2017) and humans (Chung and Tan, 2018). Phenolic compounds (flavonoids) or more (polyphenolic) aromatic rings with attached hydroxyl groups as part of their structure (proanthocyanidins et al., 2015). The human benefits of phenolic include prevention against various cancers (Costa et al., 2005; Silva et al., 2011; Nyberg et al., 2013; Silvestre et al., 2013; Proctor et al., 2015). Phenolic compounds (flavonoids) or more (polyphenolic) aromatic rings with attached hydroxyl groups as part of their structure (proanthocyanidins et al., 2015). The human benefits of phenolic include prevention against various cancers (Costa et al., 2005; Silva et al., 2011; Nyberg et al., 2013; Silvestre et al., 2013; Proctor et al., 2015).

**Similar to terpenoids, the presence of phenolic in milk is directly related to the phenolic composition of the diet.** (Zhang, 2009; Zhang et al., 2016; Provan et al., 2003). Higher concentrations observed during summer compared to winter (Provan et al., 2016, 2012; Tan et al., 2015) with higher concentrations observed during summer compared to winter (Provan et al., 2016, 2012; Tan et al., 2015). Higher concentrations of phenolic compounds were observed in milk from pasture-raised cattle with access to more diverse plant material compared to animals fed grain-based diets.
Animals Eating a DIVERSE Diet offer DIVERSE Array of Nutrients!

### Grass-fed Beef Nutrition (vs. Conventional Beef)

- Richer in antioxidants
- Higher in some vitamins and minerals (Vit E, Beta carotene, Calcium)
- Higher in conjugated linoleic acid (CLA)
- Improved Omega Fatty Acid Profile
- If antibiotic-free then less likely to contain antibiotic-resistant bacteria (e.g. e.coli)
- Nutritional content depends heavily on specific production practices and seasonality of grazing

Source: Mary Jo Forbord, RD – Prairie Horizon Farms (Is the Grass Really Greener? Understanding the Benefits of Grass-fed Products)
Grass-fed Dairy Nutrition (vs. Conventional dairy)

- Full fat contains the most nutrients
- Higher in conjugated linoleic acid (CLA)
- Rich in minerals like calcium, potassium, and vitamin D
- Higher levels of protein
- Higher in vitamins A & E
- Higher in vitamin K2
- Higher level of Omega 3s
- Nutritional content depends heavily on specific production practices and timing

Source: Mary Jo Forbord, RD – Prairie Horizon Farms (Is the Grass Really Greener? Understanding the Benefits of Grass-fed Products.)

Toxic Compounds in Feedlot Beef

Sampling of Glyphosate Levels in Various Foods

prepared by Health Research Institute, www.HRILabs.org

- red wine (organic), 1
- red wine (conventional), 19
- German beer, 30
- honey, 64
- corn flakes, 79
- eggs, 107
- soy sauce, 242
- cattle feed, 400
- whole wheat bagels, 490
- Cheerios, 1125
- Quaker Oats, 1180

glyphosate level, parts per billion
Regenerating Human Health Starts with the Microbiome

Healthy soils for healthy plants for healthy humans

How beneficial microbes in the soil, food and gut are interconnected and how agriculture can contribute to human health

Volume 21
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5 August 2020
IN THIS ISSUE
Microbiome Diversity

I disagree 😅

Microbiome Diversity = IMPROVED HEALTH!

Fiber – is it really that beneficial?

Perhaps PHYTOCHEMICALS have a stronger influence on a DIVERSE microbiome
Can Phytonutrients in Meat, Eggs, & Dairy influence GUT DIVERSITY?

Polyphenols can impact the composition of the gut microbiota (which are independently associated with health benefits), and gut bacteria metabolize polyphenols into bioactive compounds that produce clinical benefits.

What Nutrients Are Needed for Healthy Digestion?

GASTROINTESTINAL HEALTH

**Selenium**
- Coenzyme; activates enzymes in the intestinal mucosa (gut wall);
- Recycles antioxidants such as vitamins C & E.
- Deficiency: increased oxidant stress, decreased immune function.

**Glutathione**
- Coenzyme; activates enzymes in the intestinal mucosa (gut wall);
- Recycles antioxidants such as vitamins C & E.
- Deficiency: increased oxidant stress, decreased immune function.

**Lipoic Acid**
- Serves as a coenzyme for the electron transport chain;
- Important for energy production;
- Deficiency: increased oxidant stress, decreased immune function.

**Magnesium**
- Essential for muscle function;
- Important for energy production;
- Deficiency: increased oxidant stress, decreased immune function.

**Choline**
- Essential for nerve function;
- Important for energy production;
- Deficiency: increased oxidant stress, decreased immune function.

**Folate**
- Essential for DNA synthesis;
- Important for energy production;
- Deficiency: increased oxidant stress, decreased immune function.

**Vitamin B12**
- Essential for neural function;
- Important for energy production;
- Deficiency: increased oxidant stress, decreased immune function.

**Glutamine**
- Preferred fuel for enterocytes (small intestine cells), which are the most numerous in the entire body;
- Deficiency: increased oxidant stress, decreased immune function.

**Zinc**
- Essential for immune function;
- Important for energy production;
- Deficiency: increased oxidant stress, decreased immune function.

**Vitamin A**
- Essential for vision;
- Important for energy production;
- Deficiency: increased oxidant stress, decreased immune function.

**Vitamin C**
- Essential for immune function;
- Important for energy production;
- Deficiency: increased oxidant stress, decreased immune function.

**Vitamin D**
- Essential for bone health;
- Important for energy production;
- Deficiency: increased oxidant stress, decreased immune function.

**Vitamin E**
- Essential for immune function;
- Important for energy production;
- Deficiency: increased oxidant stress, decreased immune function.
Top Food Sources of Nutrients for Digestive Support

<table>
<thead>
<tr>
<th>NUTRIENT</th>
<th>DIGESTIVE FUNCTION</th>
<th>TOP FOOD SOURCES</th>
</tr>
</thead>
<tbody>
<tr>
<td>B1 (Thiamin)</td>
<td>Energy production, muscle &amp; nerve function within stomach &amp; intestines</td>
<td>Pork, Beef, Chicken, Eggs, Legumes, Whole Grains, nutritional yeast</td>
</tr>
<tr>
<td>B2 (Riboflavin)</td>
<td>Energy production, fat digestion in liver, helps us utilize Vit A &amp; Iron</td>
<td>LIVER (especially Lamb), Kidney, Heart, Meat especially Beef, Eggs, Dairy, Almonds, Salmon, Mushrooms, almond</td>
</tr>
<tr>
<td>B3 (Niacin)</td>
<td>Energy production, supports function of all cells in GI tract</td>
<td>LIVER (beef, lamb, pork), Fish, Nutritional yeast, Meat, Mushrooms</td>
</tr>
<tr>
<td>B5 (Pantothenic Acid)</td>
<td>Energy production, supports function of all cells in GI tract, builds healthy cell membranes</td>
<td>Nutritional yeast, LIVER (chicken, beef, lamb), Sunflower seeds, Beef, Pancreas or Kidney, Lam Kidney, Pork liver, Mushrooms, Eggs</td>
</tr>
<tr>
<td>B6 (Pyrodoxine)</td>
<td>Bile production, protein digestion, supports mucosa layer in GI tract</td>
<td>Nutritional yeast, LIVER (beef, turkey, chicken, lamb), Fish, Chicken, Turkey, Beef, Pistachio, Sesame seeds, sunflower seeds, Walnuts, Avocados</td>
</tr>
<tr>
<td>B12 (Cobalamin)</td>
<td>Energy production, supports function of all cells in GI tract, boosts choline which supports bile production</td>
<td>LIVER, Oysters, Clams, Nori (seaweed), Meat, Poultry, Fish, Milk, Cheese, Mushroom (black trumpets, chanterelles, shitake)</td>
</tr>
</tbody>
</table>

Glutamine (amino acid): Fuel source for small intestinal cells (enterocytes) to heal and repair. BONE BROTH, Whey Protein, Dairy, Beef, chicken, Lamb, Seafood, Venison, Cabbage, Asparagus, Broccoli.

Iron (Heme-form): Supports bile production, supports thyroid which plays a role in gastric motility. LIVER (beef, lamb, pork, poultry), Other Organ Meats (Tongue, Heart, giblets), Red Meat.


Potassium, Sodium, Chloride: Gastric acid production, bile production, potassium affects gastric motility and muscle contractions. Sea Salt, Fresh Fruits and Vegetables (tomatoes, Potatoes, Carrots, Beans, Peaches, Pears, Oranges, Bananas).

Glutamine (amino acid): Fuel source for small intestinal cells (enterocytes) to heal and repair. BONE BROTH, Whey Protein, Dairy, Beef, chicken, Lamb, Seafood, Venison, Cabbage, Asparagus, Broccoli.

Iron (Heme-form): Supports bile production, supports thyroid which plays a role in gastric motility. LIVER (beef, lamb, pork, poultry), Other Organ Meats (Tongue, Heart, giblets), Red Meat.


Omega-3’s & 6’s: Their role in Inflammation & Immune Support

- **Omega-6:Omega-3 ratio** – Ideal is **1:1**
  - Most Americans Average **15:1** or higher!

- **Two Main Types of Omega-3’s:**
  - EPA
  - DHA
  - Common sources of both are wild-caught fish, pasture-raised meats, dairy and eggs

- **Two Main Types of Omega-6s:**
  - Arachadonic Acid (AA) – Omega-6
  - Conventionally raised animals on grains & soy
  - Linoleic Acid (LA) – Omega-6
  - Margarine, canola oil, soybean oil, etc.

- **AA/EPA Ratio** is very important to evaluate
  - **HIGH** ratio indicates **INFLAMMATION**
  - **optimal levels** are **BELOW 5:1**

Image from Nordic Naturals

Informaion derived from Chris Masterjohn's Vitamins & Minerals Guide 101
Sample OmegaCheck™ Reports

Patient with LOW Inflammation

Patient with HIGH inflammation

Grass-fed Beef: What about Omega 6:3 ratios?

- Grass-fed beef O6/O3:
  - 2.29 (steak)
  - 1.73 (ground)

- Conventional beef O6/O3:
  - 8.39 (steak)
  - 6.78 (ground)

- Significantly BETTER O6/O3 ratio in grass-fed beef

Grass-fed Beef: What about Omega 6:3 ratios?

<table>
<thead>
<tr>
<th>Fatty Acids</th>
<th>Grass (n 5)</th>
<th>Concentrate (n 4)</th>
<th>p*</th>
<th>Mean</th>
<th>SEM</th>
<th>Mean</th>
<th>SEM</th>
<th>p*</th>
<th>Mean</th>
<th>SEM</th>
<th>Mean</th>
<th>SEM</th>
<th>p*</th>
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<tbody>
<tr>
<td>Fatty acids</td>
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<td></td>
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<td></td>
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</tr>
<tr>
<td>Total fat</td>
<td>2.49</td>
<td>0.39</td>
<td>5.31</td>
<td>0.08</td>
<td>0.01</td>
<td>7.76</td>
<td>0.35</td>
<td>9.46</td>
<td>0.04</td>
<td>0.02</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>SFA1</td>
<td>1409.02</td>
<td>44.09</td>
<td>1384.58</td>
<td>54.63</td>
<td>0.43</td>
<td>3747.94</td>
<td>90.87</td>
<td>3572.07</td>
<td>68.87</td>
<td>0.23</td>
<td></td>
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<tr>
<td>MUFA1</td>
<td>1416.48</td>
<td>64.41</td>
<td>1349.4</td>
<td>58.77</td>
<td>0.42</td>
<td>3741.79</td>
<td>77.73</td>
<td>3905.65</td>
<td>58.62</td>
<td>0.19</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18:1n9 (TVA)</td>
<td>69.93</td>
<td>22.53</td>
<td>86.99</td>
<td>24.19</td>
<td>0.63</td>
<td>203.03</td>
<td>14.45</td>
<td>192.93</td>
<td>10.32</td>
<td>0.64</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18:2n6 L(Ala)</td>
<td>15.30</td>
<td>1.99</td>
<td>18.27</td>
<td>2.14</td>
<td>0.37</td>
<td>64.19</td>
<td>7.26</td>
<td>63.87</td>
<td>5.19</td>
<td>0.98</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>20:4n6 (AA)</td>
<td>15.98</td>
<td>1.64</td>
<td>19.83</td>
<td>1.67</td>
<td>0.09</td>
<td>19.71</td>
<td>1.14</td>
<td>96.38</td>
<td>1.15</td>
<td>0.02</td>
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<tr>
<td>Total n6 PUFAs</td>
<td>196.88</td>
<td>16.81</td>
<td>187.28</td>
<td>24.45</td>
<td>0.03</td>
<td>165.11</td>
<td>16.01</td>
<td>248.91</td>
<td>12.14</td>
<td>0.01</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18:3n6 (ALA)</td>
<td>33.19</td>
<td>1.08</td>
<td>37.52</td>
<td>1.57</td>
<td>0.02</td>
<td>77.04</td>
<td>3.53</td>
<td>32.49</td>
<td>2.67</td>
<td>&lt;0.01</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>20:5n3 (EPA)</td>
<td>13.24</td>
<td>0.66</td>
<td>16.39</td>
<td>1.06</td>
<td>0.01</td>
<td>14.47</td>
<td>0.79</td>
<td>5.79</td>
<td>0.59</td>
<td>&lt;0.01</td>
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</tr>
<tr>
<td>22:5n3 (DPA)</td>
<td>11.84</td>
<td>0.88</td>
<td>10.33</td>
<td>0.19</td>
<td>0.01</td>
<td>13.91</td>
<td>1.17</td>
<td>11.07</td>
<td>0.80</td>
<td>0.02</td>
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<td></td>
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<tr>
<td>22:6n3 (DHA)</td>
<td>0.35</td>
<td>0.31</td>
<td>0.99</td>
<td>0.36</td>
<td>0.44</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>n-3 PUFAs</td>
<td>25.27</td>
<td>1.30</td>
<td>18.68</td>
<td>1.86</td>
<td>0.03</td>
<td>28.92</td>
<td>2.07</td>
<td>16.86</td>
<td>1.53</td>
<td>0.03</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>p&lt;0.05</td>
<td>2.99</td>
<td>0.08</td>
<td>3.39</td>
<td>0.83</td>
<td>0.01</td>
<td>17.29</td>
<td>0.29</td>
<td>26.78</td>
<td>0.22</td>
<td>&lt;0.01</td>
<td></td>
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</tr>
</tbody>
</table>

1. Significance in mean values between treatment groups with total fat content as covariate in ANCOVA (P<0.05).
Grass-fed Beef: How does it alter human O6:O3 ratios?

- 38 human study subjects fed:
  - Grass-fed beef (18 ppl)
  - Conventional beef (20 ppl)
- 4-week long study
- Omega 6:3 levels measured before and after change in diet
- Grass-fed group had a ~30% improvement in O6/O3 ratio
- Conventional group had a ~50% worse ratio

### Table 2. Fatty acid composition of plasma at baseline and post-intervention according to study group (% of total fatty acids)

<table>
<thead>
<tr>
<th>Fatty acids</th>
<th>Grass group (n=18)</th>
<th>Conventional group (n=20)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>Post-intervention</td>
<td>Baseline</td>
</tr>
<tr>
<td>C14:0</td>
<td>1.0%</td>
<td>1.1%</td>
</tr>
<tr>
<td>C16:0</td>
<td>24.3%</td>
<td>25.4%</td>
</tr>
<tr>
<td>C16:1c</td>
<td>1.9%</td>
<td>1.4%</td>
</tr>
<tr>
<td>C18:0</td>
<td>6.3%</td>
<td>8.0%</td>
</tr>
<tr>
<td>C18:1c</td>
<td>2.4%</td>
<td>6.2%</td>
</tr>
<tr>
<td>C20:4n6 (LA)</td>
<td>27.8%</td>
<td>25.2%</td>
</tr>
<tr>
<td>C18:3n3 (ALA)</td>
<td>1.3%</td>
<td>1.6%</td>
</tr>
<tr>
<td>C18:1n11 (TVA)</td>
<td>0.4%</td>
<td>0.5%</td>
</tr>
<tr>
<td>C20:4n6 (AA)</td>
<td>8.0%</td>
<td>6.7%</td>
</tr>
<tr>
<td>C20:5n3 (EPA)</td>
<td>0.7%</td>
<td>0.9%</td>
</tr>
<tr>
<td>C22:5n6 (DPA)</td>
<td>0.1%</td>
<td>0.1%</td>
</tr>
<tr>
<td>C22:5n3 (DHA)</td>
<td>0.9%</td>
<td>0.9%</td>
</tr>
<tr>
<td>SFAs</td>
<td>31.0%</td>
<td>30.7%</td>
</tr>
<tr>
<td>MUFA</td>
<td>21.0%</td>
<td>22.0%</td>
</tr>
<tr>
<td>Total n6 PUFA</td>
<td>35.9%</td>
<td>39.3%</td>
</tr>
<tr>
<td>LA, linoleic acid</td>
<td>9.1%</td>
<td>8.2%</td>
</tr>
<tr>
<td>CL, conjugated linoleic acid</td>
<td>0.4%</td>
<td>0.5%</td>
</tr>
<tr>
<td>CL, conjugated linoleic acid</td>
<td>0.4%</td>
<td>0.5%</td>
</tr>
</tbody>
</table>

**Significance in mean values between groups at baseline:**

- Significant in mean values between groups at baseline: baseline value as covariate in ANCOVA (P < 0.05).

### CASE STUDY #1 – 44 year old female w/SIBO, Celiac Disease

High Omega-3s without Fish or Fish Oil? Primarily from Meat!
How does meat impact inflammation levels in humans?

- Study that Fred Provenza refers to often →
- 10 individuals used in crossover study
- Inflammation markers measured before and AFTER consumption of two types of meat:
  - CAFO Beef
  - Wild Kangaroo

"Loin steak (100 g) from either kangaroo or wagyu was given with a standardised portion of baked potato (75 g) and green peas (50 g)."

"Low-grade systemic inflammation ('metaflammation') has been proposed as an underlying cause of much chronic disease(3)."

"As visible fat was also cut from the wagyu meat in the present study, the difference in inflammatory reaction may have been even greater between kangaroo and other beef."

Fred & Van Vliet working on a study similar to this!
“Functional Testing” in Integrative Medicine

• An advanced way of assessing one’s nutrient status & Metabolic health that goes far beyond traditional “routine” lab work

• Functional Testing I use in my practice:
  • Advanced Lipid Panels – cholesterol & including inflammation markers
  • Micronutrient Testing - vitamin and mineral deficiencies
  • Food Sensitivity Testing - evaluate immune system reactions to foods
  • Advanced Stool Testing - evaluate the microbiome & upper GI fxn
  • Omega 3 & 6 Testing
  • Hormones - assesses hormone imbalances
  • Organic Acid Testing - evaluates fungal overgrowth, nutrients, and toxins

CASE STUDY #2 – 47 year old male, prediabetes, high cholesterol

Cholesterol Improvement

• DIETARY & LIFESTYLE INTERVENTIONS (March 2019):
  • Increased pasture-raised meat in diet
  • Switched to more organic products
  • Dramatically decreased carbohydrate consumption

• HEALTH OUTCOMES:
  • INCREASE in HDL “Good cholesterol”
  • DECREASE in LDL “Bad cholesterol”
  • DECREASE in Triglycerides
  • Decrease in inflammation & joint pain
  • Improved body composition
  • Reduced diabetes markers

<table>
<thead>
<tr>
<th>Marker</th>
<th>Units</th>
<th>03/05/2019</th>
<th>07/25/2019</th>
<th>03/10/2020</th>
<th>04/21/2020</th>
<th>07/02/2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cholesterol, Total</td>
<td>mg/dL</td>
<td>200 ↑</td>
<td>237 ↑</td>
<td>212 ↑</td>
<td>240 ↑</td>
<td>226 ↑</td>
</tr>
<tr>
<td>HDL Cholesterol</td>
<td>mg/dL</td>
<td>68</td>
<td>60</td>
<td>84 ↑</td>
<td>90 ↑</td>
<td>89</td>
</tr>
<tr>
<td>Triglycerides (TG)</td>
<td>mg/dL</td>
<td>99</td>
<td>129 ↑</td>
<td>77</td>
<td>102 ↑</td>
<td>89</td>
</tr>
<tr>
<td>LDL Cholesterol</td>
<td>mg/dL</td>
<td>190.2 ↑</td>
<td>102 ↑</td>
<td>112.6</td>
<td>132 ↑</td>
<td>89</td>
</tr>
<tr>
<td>Cholesterol/HDL Ratio</td>
<td>Ratio</td>
<td>4.24 ↑</td>
<td>3.95 ↑</td>
<td>2.52</td>
<td>2.53</td>
<td>2.53</td>
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</table>

<table>
<thead>
<tr>
<th>Alarm Min</th>
<th>Lab Min</th>
<th>Optimal Min</th>
<th>Optimal Max</th>
<th>Lab Max</th>
<th>Alarm Max</th>
</tr>
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<tbody>
<tr>
<td>120</td>
<td>180</td>
<td>240</td>
<td>270</td>
<td>330</td>
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</tr>
<tr>
<td>30</td>
<td>40</td>
<td>55</td>
<td>85</td>
<td>95</td>
<td></td>
</tr>
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<td>0</td>
<td>25</td>
<td>50</td>
<td>150</td>
<td>199</td>
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</tr>
<tr>
<td>30</td>
<td>55</td>
<td>60</td>
<td>169</td>
<td>190</td>
<td></td>
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<tr>
<td>0</td>
<td>0</td>
<td>3.6</td>
<td>5</td>
<td>7</td>
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</tr>
</tbody>
</table>
CASE STUDY #2 – 47 year old male, prediabetes, high cholesterol

Inflammation Improvements

<table>
<thead>
<tr>
<th>Test</th>
<th>July 2019</th>
<th>July 2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insulin</td>
<td>11.0</td>
<td>11.0</td>
</tr>
<tr>
<td>hs-CRP</td>
<td>0.55</td>
<td>0.10</td>
</tr>
<tr>
<td>Lipoprotein(a)</td>
<td>20.8</td>
<td>4.0</td>
</tr>
<tr>
<td>Apolipoprotein A1</td>
<td>155</td>
<td>199</td>
</tr>
<tr>
<td>Apolipoprotein B</td>
<td>108</td>
<td>96</td>
</tr>
<tr>
<td>Homocysteine</td>
<td>11.8</td>
<td>9.8</td>
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</table>

CASE STUDY #2 – 47 year old male, prediabetes, high cholesterol

Improvements in Diabetes Markers

<table>
<thead>
<tr>
<th>Marker</th>
<th>Units</th>
<th>03/05/2019</th>
<th>07/25/2019</th>
<th>03/10/2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glucose</td>
<td>mg/dL</td>
<td>97 ↑</td>
<td>99 ↑</td>
<td>90 ↑</td>
</tr>
<tr>
<td>HbA1c</td>
<td>%</td>
<td>6 ↑</td>
<td>5.7 ↑</td>
<td>5.6 ↑</td>
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</tbody>
</table>
CASE STUDY #2 – 47 year old male, prediabetes, high cholesterol

Body Composition Improvements

May 2019

<table>
<thead>
<tr>
<th>Body Composition Analysis</th>
<th>Values</th>
<th>Total Body Water</th>
<th>Lean Body Mass</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intracellular Water (lbs)</td>
<td>59.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Extracellular Water (lbs)</td>
<td>34.4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dry Lean Mass (lbs)</td>
<td>32.8</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Body Fat Mass (lbs)</td>
<td>33.3</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Muscle-Fat Analysis

- Weight: 57.4 lbs
- SMM: 56.7 lbs
- Body Fat: 33.3 lbs

Obesity Analysis

BMI: 21.3
PBF: 16.2

CASE STUDY #3 – 47 year old male w/high cholesterol, insomnia

May 2019

<table>
<thead>
<tr>
<th>Body Composition Analysis</th>
<th>Values</th>
<th>Total Body Water</th>
<th>Lean Body Mass</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intracellular Water (lbs)</td>
<td>59.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Extracellular Water (lbs)</td>
<td>34.4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dry Lean Mass (lbs)</td>
<td>32.8</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Body Fat Mass (lbs)</td>
<td>33.3</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Muscle-Fat Analysis

- Weight: 144.1 lbs
- SMM: 73.0 lbs
- Body Fat: 38.3 lbs

Obesity Analysis

BMI: 19.6
PBF: 16.2

DIETARY & LIFESTYLE INTERVENTIONS (July 2020):

- Increased pasture-raised meat in diet
- Increased ORGAN MEAT
- Switched to more organic products
- Decreased carbohydrate consumption

HEALTH OUTCOMES:

- INCREASE in HDL "Good cholesterol"
- Improvement in Chol/HDL ratio
- Off all Medications (for sleep & anxiety)
- Weight loss

<table>
<thead>
<tr>
<th>Marker</th>
<th>Units</th>
<th>05/04/2016</th>
<th>04/07/2017</th>
<th>07/22/2020</th>
<th>07/23/2020</th>
<th>12/09/2020</th>
<th>Trend</th>
<th>Alarm Min</th>
<th>Lab Min</th>
<th>Optimal Min</th>
<th>Optimal Max</th>
<th>Lab Max</th>
<th>Alarm Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cholesterol, Total</td>
<td>mg/dL</td>
<td>188</td>
<td>206</td>
<td>206</td>
<td>212</td>
<td>120</td>
<td>160</td>
<td>180</td>
<td>240</td>
<td>270</td>
<td>330</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HDL Cholesterol</td>
<td>mg/dL</td>
<td>55</td>
<td>56</td>
<td>55</td>
<td>65</td>
<td>30</td>
<td>40</td>
<td>55</td>
<td>75</td>
<td>85</td>
<td>95</td>
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<td></td>
</tr>
<tr>
<td>Triglycerides (TG)</td>
<td>mg/dL</td>
<td>50</td>
<td>47</td>
<td>↓ 57</td>
<td>55</td>
<td>55</td>
<td>0</td>
<td>25</td>
<td>50</td>
<td>150</td>
<td>199</td>
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</tr>
<tr>
<td>LDL Cholesterol</td>
<td>mg/dL</td>
<td>124</td>
<td>141</td>
<td>↑ 143</td>
<td>↑ 137</td>
<td>30</td>
<td>55</td>
<td>80</td>
<td>130</td>
<td>159</td>
<td>190</td>
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<tr>
<td>Chol/HDL Ratio</td>
<td>Ratio</td>
<td>3.42</td>
<td>3.68</td>
<td>↑ 3.75</td>
<td>↑ 3.28</td>
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<td>3.5</td>
<td>5</td>
<td>7</td>
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</tr>
<tr>
<td>TG/HDL Ratio</td>
<td>Ratio</td>
<td>1.02</td>
<td>0.84</td>
<td>1.04</td>
<td>0.85</td>
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<td>2</td>
<td>4</td>
<td>5</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>
CASE STUDY #4 – 26 year old female vegan w/digestive disorders

Critically LOW Omega-3 Status – no meat or fish!

Aug 2018 (before fish oil)

<table>
<thead>
<tr>
<th>FATTY ACIDS</th>
<th>In Range</th>
<th>Out of Range</th>
<th>Flag*</th>
<th>Relative Risk</th>
<th>Optimal Range</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Omega 3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>2.5</td>
<td>L</td>
<td>HIGH</td>
<td>6.5%</td>
<td></td>
<td>% by wt</td>
</tr>
<tr>
<td>EPA</td>
<td>0.3</td>
<td>L</td>
<td>&gt; 2.0</td>
<td>2.0%</td>
<td></td>
<td>% by wt</td>
</tr>
<tr>
<td>DPA</td>
<td>0.8</td>
<td>L</td>
<td>&gt; 1.0</td>
<td>1.0%</td>
<td></td>
<td>% by wt</td>
</tr>
<tr>
<td>DHA</td>
<td>1.4</td>
<td>L</td>
<td>&gt; 4.0</td>
<td>4.0%</td>
<td></td>
<td>% by wt</td>
</tr>
<tr>
<td>Total</td>
<td>43.4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>% by wt</td>
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</tbody>
</table>

Cleveland HeartLab measures a number of omega-3 fatty acids with AA and LA being the two most abundant forms reported.

<table>
<thead>
<tr>
<th>Acid</th>
<th>Range</th>
<th>Units</th>
<th>02/22/2019</th>
<th>10/11/2019</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arachidonic</td>
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</tr>
<tr>
<td>Omega 3</td>
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<tr>
<td>Linolenic</td>
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</tbody>
</table>

June 2019 (AFTER fish oil)

CASE STUDY #5 – 51 year old female, plant-based diet, high cholesterol

Cholesterol Improvements

• DIETARY & LIFESTYLE INTERVENTIONS
  • Added pasture-raised meats to diet & fish
  • Reduced carbohydrate consumption
  • Patient always very active, no changes

• HEALTH OUTCOMES:
  • INCREASE in HDL “Good cholesterol”
  • DECREASE in LDL “Bad cholesterol”
  • Increase in ENERGY
  • Improved body composition
  • Sleeping better

<table>
<thead>
<tr>
<th>Marker</th>
<th>Units</th>
<th>02/22/2019</th>
<th>10/11/2019</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cholesterol, Total</td>
<td>mg/dL</td>
<td>274 ↑</td>
<td>290 ↑</td>
</tr>
<tr>
<td>HDL Cholesterol</td>
<td>mg/dL</td>
<td>78</td>
<td>98 ↑</td>
</tr>
<tr>
<td>Triglycerides (TG)</td>
<td>mg/dL</td>
<td>70</td>
<td>70</td>
</tr>
<tr>
<td>LDL Cholesterol</td>
<td>mg/dL</td>
<td>188 ↑</td>
<td>174 ↑</td>
</tr>
<tr>
<td>Chol/HDL Ratio</td>
<td>Ratio</td>
<td>3.51 ↑</td>
<td>2.96</td>
</tr>
</tbody>
</table>
“No matter how urban our life, our bodies live by farming; we come from the earth and return to it, and so we live in agriculture as we live in flesh.

While we live our bodies are moving particles of the earth, joined inextricably both to the soil and to the bodies of other living creatures.

It is hardly surprising, then, that there should be some profound resemblances between our treatment of our bodies and our treatment of the earth.”

-Wendell Berry