The Paleo Diet: Stone Age Nutrition for the 21st Century Athlete?

Steve Hertzler, PhD, RD, LD
Abbott Nutrition
Finally...the diet book to end all diet books!

- Julie (my wife): Stop fighting it! Just write a diet book and get rich!
- Steve: But, honey, nutrition is a complex science with many nuances. How could I possibly capture all of that in one diet book?
- Julie: Americans spend $40 billion per year on weight loss products. What was your salary again?
- Steve: Hmm...good point. Ok, I will give it a shot.
Two months later....
My ticket to fame, fortune, and getting on Dr. Oz!

Just Eat What I Eat And Shut Up!

Trust Me, I’m A Doctor

By “Iron” Steve Hertzler, PhD, RD, LD

Go From Geek to Adonis By Eating Only The Foods I Eat! No Guesswork! No Thinking! Instantaneous!

AND…

No Exercise!
Acknowledgement

- Alan Aragon developed a very nice presentation on the Paleo diet for NSCA Personal Trainers Conference 2013 and I have adopted and modified some of the concepts from his presentation for this talk
Critiquing the Paleo Diet for Athletes

- The Paleo Diet for Athletes: What is it?
- What are the positive features of the diet?
- What are some common points of contention that many dietitians would have?
- How strong is the scientific support for the Paleo diet?
- What is the take home message on this diet?

The authors

Loren Cordain, PhD

Joe Friel, MS
Educational background of the authors

- **Loren Cordain**
  - 1972, B.S., Health Sciences, Pacific University, Forest Grove, OR
  - 1978, M.S., Exercise Physiology, University of Nevada-Reno, Reno, NV
  - 1981, Ph.D., Exercise Physiology, University of Utah, Salt Lake City, UT

- **Joe Friel**
  - MS in exercise science
  - USA Triathlon and USA Cycling certified Elite-level coach

Sources:
http://www.hes.chhs.colostate.edu/faculty-staff/cordain.aspx
http://joefriel.typepad.com/blog/bio.html
Key premises of the Paleo diet

- The current agriculturally-based diet is mismatched with our genes, which were developed during the Paleolithic period and have changed little since.

- If a food was not available to Paleolithic humans, we generally should not eat it.
  - “Could I eat this if I were naked with a sharp stick on the savanna?”

- The Paleolithic diet is the diet humans were “designed” to eat.

### Modern Foods to Avoid

<table>
<thead>
<tr>
<th>DAIRY FOODS</th>
<th>LEGUMES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Milk</td>
<td>All beans (kidney, pinto, navy, white, lima, black, and broad beans) including string beans</td>
</tr>
<tr>
<td>Cheese</td>
<td>Lentils</td>
</tr>
<tr>
<td>Butter</td>
<td>Peas, snow peas</td>
</tr>
<tr>
<td>Cream</td>
<td>Peanuts (peanuts are legumes, not nuts)</td>
</tr>
<tr>
<td>Yogurt</td>
<td>Soybeans and all soybean products</td>
</tr>
<tr>
<td>Ice cream</td>
<td>Chickpeas and garbanzo beans</td>
</tr>
<tr>
<td>Ice milk</td>
<td></td>
</tr>
<tr>
<td>Frozen yogurt</td>
<td></td>
</tr>
<tr>
<td>Powdered milk</td>
<td></td>
</tr>
<tr>
<td>Nonfat creamer</td>
<td></td>
</tr>
<tr>
<td>Dairy spreads</td>
<td></td>
</tr>
<tr>
<td>All processed foods made with dairy products</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CEREAL GRAINS</th>
<th>YEAST-CONTAINING FOODS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheat (bread, rolls, muffins, noodles, crackers, cookies, cake, doughnuts, pancakes, waffles, pasta, tortillas, pizza, pita bread, flat bread, and all processed foods made with wheat or wheat flour)</td>
<td>Breads, doughnuts, rolls, muffins</td>
</tr>
<tr>
<td>Rye (bread, crackers, and all processed foods made with rye)</td>
<td>All fermented foods (beer, wine, pickled foods, foods containing vinegar, and tofu)</td>
</tr>
<tr>
<td>Barley (soup, bread, and all processed foods made with barley)</td>
<td></td>
</tr>
<tr>
<td>Oats (instant oatmeal, rolled oats, and all processed foods made with oats)</td>
<td></td>
</tr>
<tr>
<td>Corn (corn of the cob, corn tortillas, corn starch, corn syrup)</td>
<td></td>
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<tr>
<td>Rice (including brown, white, wild, and basmati; ramen and rice noodles; rice cakes; rice flour; and all processed foods made with rice)</td>
<td></td>
</tr>
<tr>
<td>Millet</td>
<td>Sausages, bacon</td>
</tr>
<tr>
<td>Sorghum</td>
<td>Processed meats (lunch meats, deli meats, preserved or smoked meats such as ham and turkey, and smoked or dried and salted fish)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CEREAL GRAIN-LIKE SEEDS</th>
<th>PROCESSED AND CANNED MEATS AND FISH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amaranth</td>
<td>Canned or pickled meats and fish (tuna, sardines, herrings, smoked oysters and clams, canned salmon and mackerel, chicken, and beef)</td>
</tr>
<tr>
<td>Chia seeds</td>
<td></td>
</tr>
<tr>
<td>Quinoa</td>
<td></td>
</tr>
<tr>
<td>Buckwheat</td>
<td></td>
</tr>
</tbody>
</table>

Note: All alcoholic beverages (permitted in moderation; see Chapter 11)

<table>
<thead>
<tr>
<th>SWEETS</th>
</tr>
</thead>
<tbody>
<tr>
<td>All candy</td>
</tr>
<tr>
<td>Honey</td>
</tr>
<tr>
<td>Dried fruit (permitted in moderation; see Chapter 11)</td>
</tr>
</tbody>
</table>

*Note that these foods are not forever banned from your diet, but are to be regularly avoided; see Chapter 11.*
Preface to this critique

- This review will focus on the nutrition science part of this book as it relates to athletes.
- I claim no expertise in the history or determination of what Paleolithic hominins ate.
  - However, it seems difficult to imagine one basic diet covering the entire period from 10,000 to 2.5 million years ago and people living in a wide range of climates and geographic regions.
- Suffice it to say, there are several references that offer differing viewpoints on controversies over:
  - what Paleolithic hominins really ate.
  - the ability to actually replicate the Paleolithic diet in modern times.
  - the degree to which the human genetic profile has evolved to handle foods in the modern diet.
- For interesting reading on these topics, please see the following slides.
What was the Paleo diet? Was starch really a part of the diet?

- Papers supporting high intakes of animal foods in Paleolithic diet

- Evidence that Paleolithic hominins ate plant foods (with cooking and processing)
Can the Paleo diet be replicated in modern times? Should we attempt to replicate it?

- Evidence that it is neither possible nor recommended to try to replicate the Paleo diet
  - Christina Warriner 2012 TED presentation  
    ([http://www.youtube.com/watch?v=BMOjVYgYaG8](http://www.youtube.com/watch?v=BMOjVYgYaG8))
Have our “nutritional genetics” truly stopped evolving?

- Evidence that humans are continuing to evolve in response to diet and environment in the post-agricultural period

- Key highlights from these articles:
  - Development of lactase persistence trait arose quickly after dairying began 7,000-9,000 y ago
  - Populations consuming more starchy carbs have more copies of the salivary amylase gene
Generally “good” features of the Paleo Diet for Athletes

- Emphasis on:
  - Lean meats for protein
  - Eating an abundance of fruits and vegetables
  - Avoiding a lot of refined and processed carbohydrates
  - Benefits of healthy fats

- Discussion of the glycemic index (GI) concept and recognition of benefits of low GI fruits and vegetables

- Recognition of factors altering glycogen storage in muscle
  - Glycemic index, nutrient timing

- Knowledge of exercise intensity and how it affects substrate utilization in muscle

- Exceptions to normal Paleo diet rules for before, during, and after competition for endurance athletes with higher carbohydrate requirements
Generally “good” features of the Paleo Diet for Athletes

- Discussion on what causes muscle cramps (pp. 44-45) is generally in keeping with latest research on what causes muscle cramps
  - Not just as simple as a dehydration effect
- Discussion on positive effects of lactic acid (pp. 40-41) is also pretty much in tune with current understanding of metabolic fate of lactic acid
  - Presents positive functions of lactic acid as a fuel source and debunks some of the misunderstandings about lactic acid and fatigue
Points of objection with the Paleo Diet for Athletes

1) The only types of athletes discussed in the book are endurance athletes
   – No studies to back up this diet for any athletes, let alone endurance athletes

2) The diet requires numerous exceptions before, during, and after exercise to meet the needs of endurance athletes
   – If so many exceptions are needed, what is so special about this diet?

3) Diet is nutritionally inadequate, expensive
   – Calcium, fiber, iron, carbohydrates are major concerns
   – What about athletes with high caloric requirements? Examples given are for a 25 y old woman needing 2200 kcal/d

4) Ideas expressed regarding acid-producing foods, buffering of pH from calcium in bones, and calcium losses from bones are flat out wrong

5) “Off the wall” concerns about peanuts, canola oil, and n-6:n-3 ratio

6) Today’s longest-living peoples don’t really eat a Paleo diet
Objection no. 1: Research on Paleo diet in endurance athletes (or any athletes)

- On page 18, it very clearly states that this book is for athletes doing races (running, cycling, triathlon, rowing, swimming, and cross-country skiing)
  - What about other athletes?

- Lack of any research studies of a Paleo diet approach in athletes!!
  - Present studies only in sedentary individuals or individuals with type 2 diabetes (T2D) or ischemic heart disease (IHD)
  - Basically examined satiety and changes in metabolic biomarkers (no performance indicators)

- In the older version of the book, there is a discussion of supplements
  - Did Paleolithic hominins take supplements?
  - Supplements such as creatine or HMB not even discussed, because they were only for strength athletes
  - Supplement information not present in current version of the book
Paleo diet designed for all athletes?

Nathan Leeper  
High jump  
6'2" 180 lbs.

King Kamali  
Bodybuilding  
5'10" 248 lbs.

Shane Hanman  
Weightlifting  
5'9" 370 lbs.

Michael Smedley  
Triathlon  
5'11" 155 lbs.

Rulon Gardner  
Wrestling  
6'2"  266 lbs.
Paleo diet designed for all athletes?
What does the human research out there on Paleo diet really say?

- Studies all on subjects that had one or more of the following characteristics:
  - Sedentary
  - Overweight or obese with increased waist circumference
  - Type 2 diabetes
  - Ischemic heart disease

- Almost every study came from essentially the same research group in Sweden

- In these studies, Paleo diet was significantly different in either energy or macronutrients vs. control diet
  - Difficult to separate out effects of diet itself vs. simple energy restriction
# Paleo diet study summary table

<table>
<thead>
<tr>
<th>Study</th>
<th>Subjects and design</th>
<th>Duration</th>
<th>Paleo kcals, macronutrients and fiber</th>
<th>Control kcals, macronutrients and fiber</th>
<th>Findings</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jönsson et al., 2010</td>
<td>29 M with IHD, impaired glucose tolerance or T2D, and WC &gt;94 cm; randomized independent groups; subjects instructed on diets</td>
<td>12 weeks</td>
<td>1388 kcal/d 92 g P, 129 g C, 46 g F 22 g fiber</td>
<td>Mediterranean-type diet; 1823 kcal/d 88 g P, 211 g C, 59 g F 27 g fiber</td>
<td>Paleo diet more satiating per kcal</td>
<td>Paleo diet sig. lower in calcium (374 vs. 772 mg/d)</td>
</tr>
<tr>
<td>Jönsson et al., 2013</td>
<td>13 patients with T2D; randomized crossover; subjects instructed on diets</td>
<td>3 months per phase, with no washout phase described</td>
<td>Paleo diet lower in energy (-297 kcal), carbs (-71g/d), dietary fiber (-5.2 g/d), and calcium (-341 mg/d) Satiety quotient for energy per meal (RS/MJ) = 1.8</td>
<td>Standard diabetes diet; Macronutrients not provided; Satiety quotient for energy per meal (RS/MJ) =1.5</td>
<td>Paleo diet more satiating per units of energy, energy density, glycemic load</td>
<td>13 comments that the Paleo diet was difficult to adhere to (4 in control phase, P =0.02);</td>
</tr>
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<tr>
<td>Lindeberg et al., 2007</td>
<td>29 M overweight IHD patients; randomized, independent groups; subjects instructed on diets</td>
<td>12 weeks</td>
<td>1344 kcal/d 90 g P, 134 g C, 42 g F 21 g fiber</td>
<td>Mediterranean diet; 1795 kcal 89 g P, 231 g C, 50 g F 27 g fiber</td>
<td>Paleo diet sig. decreased WC and several markers of glucose tolerance</td>
<td>No sig. change in body weight</td>
</tr>
<tr>
<td>Jönsson et al., 2009</td>
<td>13 patients with T2D; randomized crossover; subjects instructed on diets</td>
<td>3 months per phase, with no washout phase described</td>
<td>1581 kcal/d 94 g P, 125 g C, 68 g F 21 g fiber</td>
<td>Standard diabetes diet; 1878 kcal/d 90 g P, 196 g C, 72 g F 26 g fiber</td>
<td>Paleo diet sig. decreased BMI, HbA₁c, TG, diastolic BP, BW and WC</td>
<td>As with other studies, Paleo diet lower in energy, carbohydrate, and glycemic load. Also lower in calcium (356 mg/d) vs control diet (698 mg/d)</td>
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<td>Frasetto et al., 2009</td>
<td>9 sedentary, nonobese subjects; nonrandomized, diets prepared for subjects</td>
<td>Usual diet for 3 days (baseline), ramp-up diet (increased fiber and K) for 7 d, Paleo for 10 d</td>
<td>2701 kcal 198 g P, 249 g C, 96 g F Fiber?</td>
<td>Baseline usual diet 2372 kcal 107 g P, 254 g C, 99 g F Fiber?</td>
<td>Paleo diet, relative to baseline diet, decreased Total-C, LDL-C, VLDL-C, TG, plasma insulin AUC during OGTT, and diastolic BP and MAP</td>
<td>Diets were constructed so that no weight loss occurred. No sig. change in urinary pH. Dietary calcium intake was not different (~880 mg/d)</td>
</tr>
<tr>
<td>Österdahl et al., 2008</td>
<td>20 healthy, normal BMI subjects recruited, 14 finished study; single treatment arm (no control)</td>
<td>Paleo diet, self-selected for 3 weeks</td>
<td>1584 kcal 95 g P, 158 g C, 63 g F (data from 6 subjects)</td>
<td>Baseline usual diet 2478 kcal 84 g P, 335 g C, 82 g F</td>
<td>Reduced BW, BMI, WC, BP, PAI-1</td>
<td>Diet was low in calcium (395 mg/d); no control diet period for comparison; high dropout rate</td>
</tr>
</tbody>
</table>
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</tr>
</thead>
<tbody>
<tr>
<td>Melberg et al., 2014</td>
<td>70 obese postmenopausal women Baseline N =35/group 6 mo. N=34/27 PD/NNR 2 y N = 27/22 PD/NNR</td>
<td>Self-selected Paleo Diet (PD) or Nordic Nutrition Recommendations diet (NNR) for 2 y</td>
<td>Daily Intake: baseline/6 mo/2 y Kcal: 2000/1625/1599 C: 224/120/137 g P: 84/94/85 g F: 75/78/71 g</td>
<td>Daily Intake: baseline/6 mo/2 y Kcal: 2019/1660/1768 C: 222/181/190 g P: 85/76/76 g F: 79/61/69 g</td>
<td>PD reduced fat mass, waist circumference, and sagittal diameter vs. NNR at 6 mo, not 2 y</td>
<td>Greater initial changes with Paleo diet, but changes not maintained by 2 y of intervention</td>
</tr>
</tbody>
</table>
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</tr>
</thead>
<tbody>
<tr>
<td>Smith et al., 2014</td>
<td>24 healthy males (33.5 y) and 20 females (31.2 y) BMI 25-28 kg/m², normolipidemic</td>
<td>Ad libitum Paleo diet for 10 wks, pre vs. post (no control group)</td>
<td>Dietary intake data not reported</td>
<td>No control group</td>
<td>PD increased non-HDL, LDL, and total cholesterol and reduced body fat; no change in triglycerides</td>
<td>HDL was reduced only in subjects with high HDL at baseline; increases in other lipids occurred just in those with optimal levels to start with</td>
</tr>
<tr>
<td>Study</td>
<td>Subjects and design</td>
<td>Duration</td>
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<td>Control kcals, macronutrients and fiber</td>
<td>Findings</td>
<td>Comments</td>
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</tr>
<tr>
<td>Ryberg et al., 2013</td>
<td>10 healthy, nonsmoking obese postmenopausal females (BMI &gt;27 kg/m²); age not stated</td>
<td>Ad libitum Paleo diet for 5 wks, pre vs. post (no control group)</td>
<td>Pre-PD: 2408 kcal 105 g P 281 g C 92 g F</td>
<td>No control group</td>
<td>PD weight loss was 4.6 kg; decreased in BMI, WC, diastolic BP</td>
<td>No control group, short duration, small sample size</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Post-PD: 1888 kcal 133 g P 118 g C 94.8 g F</td>
<td>Pre-PD: 2408 kcal 105 g P 281 g C 92 g F</td>
<td></td>
<td>PD decreased Total-C, LDL, TG, fasting glucose, fasting insulin, urinary C-peptide, HDL, leptin, HOMA (homeostasis model assessment), liver fat content</td>
<td>No change in physical activity</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Post-PD: 1888 kcal 133 g P 118 g C 94.8 g F</td>
<td></td>
<td>PD decreased Total-C, LDL, TG, fasting glucose, fasting insulin, urinary C-peptide, HDL, leptin, HOMA (homeostasis model assessment), liver fat content</td>
<td>No changes in whole body insulin sensitivity, intramyocellular lipid content (tibialis, soleus) or high sensitivity C-reactive protein</td>
</tr>
</tbody>
</table>
References for Paleo diet studies in humans


Objection no. 2: Exceptions to Paleo diet

Exceptions to Paleo diet are made for 5 different phases in Ch. 2, 3, and 4 of book

- Stage I: Immediately before exercise
- Stage II: During exercise
- Stage III: 30 min immediately following exercise
- Stage IV: A period equal to the duration of the preceding exercise session
- Stage V: Long-term, postexercise recovery preceding the next Stage I

Exceptions include:

- Protein powders from egg or whey as a source of branched chain amino acids (before, during, and after)
- Commercial meal replacement drinks and sports bars (before and during)
- Energy gels and sports drinks (before and during)
- High glycemic “homebrew” recovery beverage (fruit, fruit juice, glucose, protein powder)
- High glycemic load foods such as potatoes, dried fruit (after)
Exceptions to the Paleo diet

- The authors acknowledge that endurance athletes have high carbohydrate and caloric needs during competition
  - Tough to do this with salads and meat!!

- Thus, they recommend exceptions to this diet during competitions and times in close proximity to training

- Given the frequency of training of many of these athletes, it may be questionable exactly how much time is truly able to be devoted to Paleo principles vs. exceptions
Objection no. 3: Paleo diet is nutritionally inadequate and expensive

- The authors devised a one-day sample Paleo menu and compared it with the 5-day average from the USDA Food Guide Pyramid to assess nutritional composition.
- The plan was based on a 25-year-old woman requiring 2200 kcal/d.
- The source of the USDA Food Guide Pyramid sample menus and nutritional analysis was: [http://www.nal.usda.gov/fnic/Fpyr/guide.pdf](http://www.nal.usda.gov/fnic/Fpyr/guide.pdf)
One-day sample Paleo menu (p. 9)

<table>
<thead>
<tr>
<th>Food</th>
<th>Quantity (g)</th>
<th>Energy (kcal)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breakfast</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cantaloupe</td>
<td>276</td>
<td>97</td>
</tr>
<tr>
<td>Atlantic salmon (broiled)</td>
<td>333</td>
<td>605</td>
</tr>
<tr>
<td>Lunch</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vegetable salad with walnuts</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shredded romaine lettuce</td>
<td>68</td>
<td>10</td>
</tr>
<tr>
<td>Sliced carrot</td>
<td>61</td>
<td>26</td>
</tr>
<tr>
<td>Sliced cucumber</td>
<td>78</td>
<td>10</td>
</tr>
<tr>
<td>Quartered tomatoes</td>
<td>246</td>
<td>52</td>
</tr>
<tr>
<td>Lemon-juice dressing</td>
<td>31</td>
<td>8</td>
</tr>
<tr>
<td>Walnuts</td>
<td>11</td>
<td>70</td>
</tr>
<tr>
<td>Broiled lean pork loin</td>
<td>86</td>
<td>205</td>
</tr>
<tr>
<td>Dinner</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vegetable, avocado, and almond salad</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shredded mixed greens</td>
<td>112</td>
<td>16</td>
</tr>
<tr>
<td>Tomato</td>
<td>123</td>
<td>26</td>
</tr>
<tr>
<td>Avocado</td>
<td>85</td>
<td>150</td>
</tr>
<tr>
<td>Silvered almonds</td>
<td>45</td>
<td>260</td>
</tr>
<tr>
<td>Sliced red onion</td>
<td>29</td>
<td>11</td>
</tr>
<tr>
<td>Lemon-juice dressing</td>
<td>31</td>
<td>8</td>
</tr>
<tr>
<td>Steamed broccoli</td>
<td>468</td>
<td>131</td>
</tr>
<tr>
<td>Lean beef sirloin tip roast</td>
<td>235</td>
<td>400</td>
</tr>
<tr>
<td>Dessert</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strawberries</td>
<td>130</td>
<td>39</td>
</tr>
<tr>
<td>Snacks</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Orange</td>
<td>66</td>
<td>30</td>
</tr>
<tr>
<td>Carrot sticks</td>
<td>81</td>
<td>35</td>
</tr>
<tr>
<td>Celery sticks</td>
<td>90</td>
<td>14</td>
</tr>
</tbody>
</table>
### Dietary Characteristics of a Contemporary Diet
Based on Paleolithic Food Groups and in a Recommended USDA Food Pyramid Diet for a Woman
(25 years old; 2,200-calorie daily intake)

<table>
<thead>
<tr>
<th>NUTRIENT</th>
<th>FOOD PYRAMID</th>
<th>MODERN PALEO DIET</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protein (g)</td>
<td>113</td>
<td>217</td>
</tr>
<tr>
<td>Protein (% energy)</td>
<td>20</td>
<td>38</td>
</tr>
<tr>
<td>Carbohydrate (g)</td>
<td>302</td>
<td>129</td>
</tr>
<tr>
<td>Carbohydrate (% energy)</td>
<td>53</td>
<td>23</td>
</tr>
<tr>
<td>Total sugars (g)</td>
<td>96.6</td>
<td>76.5</td>
</tr>
<tr>
<td>Fiber (g)</td>
<td>30</td>
<td>42.5</td>
</tr>
<tr>
<td>Fat (grams)</td>
<td>67</td>
<td>100.3</td>
</tr>
<tr>
<td>Fat (% total energy)</td>
<td>27</td>
<td>39</td>
</tr>
<tr>
<td>Saturated fat (g)</td>
<td>19.6</td>
<td>18</td>
</tr>
<tr>
<td>Saturated fat (% total energy)</td>
<td>7</td>
<td>6.4</td>
</tr>
<tr>
<td>Monounsaturated fat (g)</td>
<td>22.8</td>
<td>44.3</td>
</tr>
<tr>
<td>Polyunsaturated fat (g)</td>
<td>19</td>
<td>26.7</td>
</tr>
<tr>
<td>Omega-3 fatty acids (g)</td>
<td>1</td>
<td>9.6</td>
</tr>
<tr>
<td>Omega-6 fatty acids (g)</td>
<td>14.3</td>
<td>14.2</td>
</tr>
<tr>
<td>Cholesterol (mg)</td>
<td>219</td>
<td>461</td>
</tr>
<tr>
<td>Sodium (mg)</td>
<td>2,626</td>
<td>726</td>
</tr>
<tr>
<td>Potassium (mg)</td>
<td>3,450</td>
<td>9,062</td>
</tr>
</tbody>
</table>
### Trace Nutrients in a Modern Diet Based on Paleolithic Food Groups and in a Recommended USDA Food Pyramid Diet for Women (25 years old; 2,200-calorie daily intake)

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Food Pyramid</th>
<th>% RDA</th>
<th>Modern Paleolithic Diet</th>
<th>% RDA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vitamin A</td>
<td>1,659 mcg RE</td>
<td>207</td>
<td>6,386 mcg RE</td>
<td>798</td>
</tr>
<tr>
<td>Vitamin B₁</td>
<td>2.3 mg</td>
<td>209</td>
<td>3.4 mg</td>
<td>309</td>
</tr>
<tr>
<td>Vitamin B₂</td>
<td>2.6 mg</td>
<td>236</td>
<td>4.2 mg</td>
<td>355</td>
</tr>
<tr>
<td>Vitamin B₃</td>
<td>30 mg</td>
<td>214</td>
<td>60 mg</td>
<td>428</td>
</tr>
<tr>
<td>Vitamin B₆</td>
<td>2.6 mg</td>
<td>200</td>
<td>6.7 mg</td>
<td>515</td>
</tr>
<tr>
<td>Folate</td>
<td>453 mcg</td>
<td>113</td>
<td>891 mcg</td>
<td>223</td>
</tr>
<tr>
<td>Vitamin B₁₂</td>
<td>4.7 mcg</td>
<td>196</td>
<td>17.6 mcg</td>
<td>733</td>
</tr>
<tr>
<td>Vitamin C</td>
<td>233 mg</td>
<td>388</td>
<td>748 mg</td>
<td>1,247</td>
</tr>
<tr>
<td>Vitamin E</td>
<td>10 IU</td>
<td>125</td>
<td>19.5 IU</td>
<td>244</td>
</tr>
<tr>
<td>Calcium</td>
<td>1,215 mg</td>
<td>122</td>
<td>691 mg</td>
<td>69</td>
</tr>
<tr>
<td>Phosphorus</td>
<td>808 mg</td>
<td>258</td>
<td>2,546 mg</td>
<td>364</td>
</tr>
<tr>
<td>Magnesium</td>
<td>427 mg</td>
<td>138</td>
<td>643 mg</td>
<td>207</td>
</tr>
<tr>
<td>Iron</td>
<td>19 mg</td>
<td>127</td>
<td>24.3 mg</td>
<td>162</td>
</tr>
<tr>
<td>Zinc</td>
<td>14 mg</td>
<td>116</td>
<td>27.4 mg</td>
<td>228</td>
</tr>
</tbody>
</table>

*Should be 1808*
Comments on this diet and analysis

- **Calcium**
  - This sample diet, as well as all previous studies of Paleo diet, all show inadequate levels of dietary calcium
  - No truth to the authors content that the lower acid load of Paleo diet will lead to substantially lower calcium excretion and lessened calcium requirement to maintain balance (more on that later)

- **Unrealistic menu!**
  - No beverages listed—what is the person supposed to drink?
  - The 468 g of steamed broccoli is equal to about 6 cups!! Might boost the vitamin E (and fiber) to meet recommendations, but who is really going to eat that?
  - Salmon portion is 11.7 oz (at breakfast) and the beef tip roast is 8-1/4 oz.
  - Salad and meat twice per day?? Really?

- **Diet plan was only for a woman requiring 2200 kcal/d?**
  - What about a male athlete requiring 5000 plus kcal/d? Can that be done on Paleo?
Nutritional analysis and economics of Paleo diet

- Metzgar et al. (2011) studied the feasibility of a Paleo diet for low-income consumers using the USDA Thrifty Food Plan
- For Paleo diet, a 9.3% increase in income was needed for a Paleo diet that met all RDAs except calcium
- In a modeling scenario, Paleo diet met:
  - 46% of calcium requirement
  - 75% of dietary fiber requirement
  - 86% of iron requirement
- Model analysis of Paleo diet included potatoes, which are actually on the “avoid” list most of the time
  - Without potatoes, analysis for Paleo diet from a cost perspective would have been significantly worse!
Objection no. 4: Grains and dairy as high acid foods that increase calcium loss from the body?

- This is a variant of what we call the acid-ash theory
- Diet is a source of acid (H\(^+\)) and the pH of the blood is the negative log of the H\(^+\) concentration (as H\(^+\) goes up, pH goes down)
- Crux of the acid-ash theory (pp. 95, 173):
  - Grains and dairy present a high acid load to the kidney
  - Creates a mild and chronic acidic state in the blood
  - Acid load must be buffered
  - Calcium and bicarbonate extracted from bone reserves to buffer acid load
  - Calcium content of the bone decreases, bone strength suffers
  - Even the high calcium content of milk can’t overcome the calcium loss effect and net negative calcium balance ensues
- Is this theory true?
  - Let’s break it down
Where did this acid-ash theory come from?

- Short-term studies were conducted on patients with severe renal insufficiency or normal subjects given large amounts of ammonium chloride (to produce significant acidosis)
  - The patients/subjects were found to have significant acid retention, yet stable bicarbonate
    - Goodman et al. (1965) estimated net acid balance of +19 mEq/d
  - Large increases in urinary calcium and decreased net calcium balance were noted
  - Authors assumed that the bone contributed bicarbonate to replace bicarbonate used up in buffering
  - Authors presumed that the increased urinary calcium came from decreased bone stores of calcium
  - Authors therefore drew a connection between acid blood pH and calcium mobilization from bone

Potential renal acid load (PRAL) of foods presented in Paleo Diet for Athletes (p. 59)

\[
PRAL (\text{mEq}) = \text{SO}_4^2+\text{PO}_4^3+\text{Cl}^-\text{Ca}^-\text{Mg}^-\text{Na}^-\text{K}^+
\]

Higher positive values = higher acid load, or greater potential for acidity in urine

<table>
<thead>
<tr>
<th>ACID FOODS (+)</th>
<th>Fruits</th>
<th>ALKALINE FOODS (-)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grains</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brown rice</td>
<td>+12.5</td>
<td>Raisins</td>
</tr>
<tr>
<td>Rolled oats</td>
<td>+10.7</td>
<td>Black currants</td>
</tr>
<tr>
<td>Whole wheat bread</td>
<td>+8.2</td>
<td>Bananas</td>
</tr>
<tr>
<td>Spaghetti</td>
<td>+7.3</td>
<td>Apricots</td>
</tr>
<tr>
<td>Corn flakes</td>
<td>+6.0</td>
<td>Kiwifruit</td>
</tr>
<tr>
<td>White rice</td>
<td>+4.6</td>
<td>Cherries</td>
</tr>
<tr>
<td>Rye bread</td>
<td>+4.1</td>
<td>Pears</td>
</tr>
<tr>
<td>White bread</td>
<td>+3.7</td>
<td>Pineapple</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Peaches</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Apples</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Watermelon</td>
</tr>
<tr>
<td>Dairy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Parmesan cheese</td>
<td>+34.2</td>
<td>Spinach</td>
</tr>
<tr>
<td>Processed cheese</td>
<td>+28.7</td>
<td>Celery</td>
</tr>
<tr>
<td>Hard cheese</td>
<td>+19.2</td>
<td>Carrots</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Zucchini</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cauliflower</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Potatoes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Radishes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Eggplant</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tomatoes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Lettuce</td>
</tr>
<tr>
<td>Legumes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Peanuts</td>
<td>+8.3</td>
<td>Chicory</td>
</tr>
<tr>
<td>Lentils</td>
<td>+3.5</td>
<td>Leeks</td>
</tr>
<tr>
<td>Peas</td>
<td>+1.2</td>
<td>Onions</td>
</tr>
<tr>
<td>Meats, Eggs, Fish</td>
<td></td>
<td>Mushrooms</td>
</tr>
<tr>
<td>Trout</td>
<td>+10.8</td>
<td>Green peppers</td>
</tr>
<tr>
<td>Turkey</td>
<td>+9.9</td>
<td>Broccoli</td>
</tr>
<tr>
<td>Chicken</td>
<td>+8.7</td>
<td>Cucumber</td>
</tr>
<tr>
<td>Eggs</td>
<td>+8.1</td>
<td></td>
</tr>
<tr>
<td>Pork</td>
<td>+7.9</td>
<td></td>
</tr>
<tr>
<td>Beef</td>
<td>+7.8</td>
<td></td>
</tr>
<tr>
<td>Cod</td>
<td>+7.1</td>
<td></td>
</tr>
<tr>
<td>Herring</td>
<td>+7.0</td>
<td></td>
</tr>
</tbody>
</table>

Concerns with authors’ use of PRAL data in this way

- The PRAL is generally used to attempt to predict effect of diet on urine pH
  - This may have some clinical application in management of kidney stones
  - So, all that we have at this point is potential effects of foods on urine pH
  - Is there significance to this regarding overall blood acidity? To calcium balance? (more on this to come)

- Authors recommend avoiding dairy and grains due to high acid load
  - However, the meats they advocate so strongly also have a high acid load

- Acid load is the net effect of all the positive and negative PRAL values
  - In the Paleo diet, it is assumed that the alkaline effects of fruits and veggies counterbalances the acid effects of the meat
  - So, couldn’t the same result be achieved by a combination of high fruits and veggies, moderate meat and moderate grain?
More on urinary pH vs. blood pH

Due to buffering systems in the body, the blood pH is tightly regulated within the 7.35 to 7.45 range

- Blood and extracellular fluid
  - Hemoglobin binds H\(^+\) (major buffer in blood)
  - Bicarbonate system: \( H^+ + HCO_3^- \rightleftharpoons H_2CO_3 \rightleftharpoons H_2O + CO_2 \)

- Lungs
  - Respiratory rate varies to blow off more or less CO\(_2\)

- Renal (kidney) buffering
  - Reabsorption of bicarbonate and secretion of hydrogen protons
  - Disodium/monosodium phosphate system
    \[ Na_2HPO_4 + H^+ \rightleftharpoons NaH_2PO_4 + Na^+ \]
  - Formation of ammonium from ammonia
    \[ NH_3 \rightleftharpoons NH_4^+ \]

Changes in diet that alter urine pH do NOT affect blood pH because of these buffering systems (can get temporary affect with baking soda)

Why the acid-ash theory for calcium loss is incorrect

- Several papers have debunked the early studies supporting the acid-ash theory for bone loss
  - If positive hydrogen balance was really as high as stated (e.g., +19 mEq/d), the buffering of this acid by bone would cause 50% of the skeletal mass to be lost in just 1.8 y!!
    - Probably technical errors in their measurements of acid balance
  - Subjects were in acute acidosis and the effects on calcium were just temporary, not progressive and continuous
    - Patients in the more chronic and stable acidosis do not have elevation of urinary calcium (which should continue to be elevated if theory is true)
    - Findings could not be replicated in later studies of patients with stable renal insufficiency
  - There was no direct evidence of bone loss in these studies

- There are many more reasons why the Paleo diet assumptions on high acid load causing calcium loss are incorrect

Milk is NOT an acid producing food

- Despite its positive PRAL value, actual measurements of net acid excretion in clinical studies do not show milk to be a particular acid-producing food.

- Heaney and Rafferty (2001) studied milk, colas and water for effects on urinary net acid excretion:
  - Caffeinated Cola: 2.59 ± 2.40 mEq/d
  - Water (deionized): 0.84 ± 3.22 mEq/d
  - Milk (skim): -0.08 ± 4.33 mEq/d

- Milk caused only a small increase in urinary calcium excretion (10-21 mg/d).

- Spence et al. (2005) studied 40 g/d of milk protein vs. soy protein in a controlled diet setting for effect on urinary net acid excretion:
  - Milk: 40.2 ± 19 mEq/d
  - Soy: 38.6 ± 11 mEq/d

Net acid excretion can change urinary calcium excretion, but does not affect calcium balance.

Weight of the evidence does not support effect of acid-ash diets on calcium balance or bone mass

- Fenton et al. (2010) observed no relationship between low urinary pH and bone fractures or loss of bone mineral density
- Two meta-analyses by Fenton et al (2009 and 2011) also failed to support the acid-ash hypothesis
  - A key feature of the Fenton et al. (2011) meta-analysis was that only calcium balance studies meeting Institute of Medicine criteria were included
  - Included randomized controlled trials, prospective observational studies, and studies looking at bone resorption markers
  - Fenton et al. (2011) compared the evidence from 55 studies against Hill’s epidemiological criteria for causality and found that the hypothesis failed

Results of Fenton et al. (2011) meta-analysis for bone resorption markers

<table>
<thead>
<tr>
<th>Study or Subgroup</th>
<th>Alkaline (Mean, SD)</th>
<th>Control (Mean, SD)</th>
<th>Weight</th>
<th>Std. Mean Difference IV, Fixed, 95% CI</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1.1 Kerstetter 1999</td>
<td>Kerstetter 1999 48.2 (29) 16 43.5 (28) 16 2.0% 0.16 [-0.53, 0.85] 1999</td>
<td>Subtotal (95% CI) 16 16 2.0% 0.16 [-0.53, 0.85]</td>
<td>Heterogeneity: Not applicable</td>
<td>Test for overall effect: Z = 0.45 (P = 0.65)</td>
<td></td>
</tr>
<tr>
<td>2.1.2 Roughhead 2003</td>
<td>Roughhead 2003 3.77 (0.33) 13 3.80 (0.33) 13 2.2% -0.32 [-1.10, 0.45] 2003</td>
<td>Subtotal (95% CI) 13 13 2.2% -0.32 [-1.05, 0.45]</td>
<td>Heterogeneity: Not applicable</td>
<td>Test for overall effect: Z = 0.02 (P = 0.99)</td>
<td></td>
</tr>
<tr>
<td>2.1.3 Dawson Hughes 2004</td>
<td>Dawson Hughes 2004 130.3 (70.8) 16 197.6 (90.8) 16 2.6% -0.09 [-1.48, -0.04] 2004</td>
<td>Subtotal (95% CI) 16 16 2.6% -0.07 [-1.48, -0.04]</td>
<td>Heterogeneity: Not applicable</td>
<td>Test for overall effect: Z = 2.06 (P = 0.04)</td>
<td></td>
</tr>
<tr>
<td>2.1.5 Roughhead 2005</td>
<td>Roughhead 2005 3.08 (0.24) 15 3.0 (0.24) 15 2.5% -0.59 [-1.21, 0.24] 2005</td>
<td>Subtotal (95% CI) 15 15 2.5% -0.59 [-1.21, 0.24]</td>
<td>Heterogeneity: Not applicable</td>
<td>Test for overall effect: Z = 1.81 (P = 0.10)</td>
<td></td>
</tr>
<tr>
<td>2.1.6 Sakhaee 2005</td>
<td>Sakhaee 2005 CTX 0.54 (0.32) 16 0.49 (0.29) 16 3.1% 0.18 [-0.40, 0.69] 2005</td>
<td>Sakhaee 2005 NTX 33 33 14 33 33 14 3.2% 0.00 [-0.65, 0.65] 2005</td>
<td>Subtotal (95% CI) 36 36 6.3% 0.05 [-0.38, 0.58]</td>
<td>Heterogeneity: CH² = 6.12, df = 1 (P = 0.73); I² = 0%</td>
<td>Test for overall effect: Z = 0.34 (P = 0.73)</td>
</tr>
<tr>
<td>2.1.7 Spence 2005</td>
<td>Spence 2005 50.9 (29) 15 48.2 (28) 15 2.8% 0.28 [-0.44, 1.00] 2005</td>
<td>Subtotal (95% CI) 15 15 2.8% 0.28 [-0.44, 1.00]</td>
<td>Heterogeneity: Not applicable</td>
<td>Test for overall effect: Z = 0.17 (P = 0.86)</td>
<td></td>
</tr>
<tr>
<td>2.1.8 Kerstetter 2006</td>
<td>Kerstetter 2006 Soy 52 (26.9) 20 48.1 (13.4) 20 3.0% 0.18 [-0.44, 0.61] 2006</td>
<td>Kerstetter 2006 Meat 51 (16.2) 20 47.4 (11.6) 20 3.1% 0.03 [-0.08, 0.15] 2006</td>
<td>Subtotal (95% CI) 56 56 10.3% 0.15 [-0.23, 0.53]</td>
<td>Heterogeneity: CH² = 4.24, df = 2 (P = 0.123); I² = 53%</td>
<td>Test for overall effect: Z = 0.72 (P = 0.47)</td>
</tr>
<tr>
<td>2.1.9 Cogli 2008</td>
<td>Cogli 2008 40.4 (19.1) 10 35.1 (7) 9 1.6% 0.32 [-0.56, 1.25] 2008</td>
<td>Subtotal (95% CI) 9 9 1.6% 0.34 [-0.56, 1.25]</td>
<td>Heterogeneity: Not applicable</td>
<td>Test for overall effect: Z = 0.74 (P = 0.46)</td>
<td></td>
</tr>
<tr>
<td>2.1.10 MacDonald 2008</td>
<td>MacDonald Fr/veg CTX 0.21 (0.11) 47 0.2 (0.13) 54 5.8% 0.06 [-0.32, 0.44] 2008</td>
<td>MacDonald K/leatre BDP 7.6 (2.4) 42 7.1 (2.1) 44 7.5% 0.16 [-0.25, 0.56] 2008</td>
<td>MacDonald K/leatre CTX 0.2 (0.11) 47 0.31 (0.11) 50 8.5% 0.06 [-0.49, 0.31] 2008</td>
<td>MacDonald Fr/veg BDP 7.2 (2.3) 42 7.1 (2.1) 50 8.0% 0.05 [-0.36, 0.46] 2008</td>
<td>MacDonald K/leatre CTX 0.2 (0.11) 47 0.31 (0.11) 50 8.5% 0.06 [-0.49, 0.31] 2008</td>
</tr>
<tr>
<td>2.1.11 Dawson Hughes 2009</td>
<td>Dawson Hughes 2009 33.8 (17.2) 84 33.7 (13.9) 78 14.0% 0.32 [-0.01, 0.65] 2009</td>
<td>Dawson Hughes 2009 34.8 (17.2) 84 33.7 (13.9) 78 14.0% 0.32 [-0.01, 0.65]</td>
<td>Heterogeneity: Not applicable</td>
<td>Test for overall effect: Z = 2.04 (P = 0.04)</td>
<td></td>
</tr>
<tr>
<td>2.1.12 Hunt 2009</td>
<td>Hunt 2009 High Calcium 9.3 (1.2) 14 10.4 (1.2) 14 2.2% -0.89 [-1.67, -0.11] 2009</td>
<td>Hunt 2009 Low calcium 10 (1.2) 14 11.6 (1.2) 14 1.0% -1.21 [-2.09, -0.33] 2009</td>
<td>Subtotal (95% CI) 27 27 4.1% -1.04 [-1.61, -0.52]</td>
<td>Heterogeneity: CH² = 0.30, df = 1 (P = 0.59); I² = 0%</td>
<td>Test for overall effect: Z = 3.51 (P = 0.0004)</td>
</tr>
<tr>
<td>2.1.13 Karp 2009</td>
<td>Karp 2009 23 (12) 12 16 (10) 12 2.0% 0.61 [-0.21, 1.43] 2009</td>
<td>Karp 2009 23 (12) 12 16 (10) 12 2.0% 0.61 [-0.21, 1.43]</td>
<td>Subtotal (95% CI) 12 12 2.0% 0.61 [-0.21, 1.43]</td>
<td>Heterogeneity: Not applicable</td>
<td>Test for overall effect: Z = 1.46 (P = 0.14)</td>
</tr>
</tbody>
</table>

Fenton TR et al. 
*Nutr J* 2011;10:41
Dairy products, protein, phosphorus and bone health

- According to acid-ash theory, dairy products should be bad for bone due to high acid load from their protein and phosphorus.
- However, high intakes of dairy products tend to improve bone health and low intakes tend to worsen bone health.
  - Holds true in a variety of populations that have been studied.
- High protein intakes tend to increase, rather than decrease, bone strength.
  - Protein important for collagen matrix of bone and can increase intestinal calcium absorption.
  - Thus, protein-induced increases in urinary calcium don’t adversely effect calcium balance or bone health.
- High phosphorus intakes are not associated with impaired calcium balance or poorer bone health.

Heaney RP. *J Am Coll Nutr* 2009;28:82S-90S.

Objection no. 5 “Off the wall” ideas regarding peanuts, canola oil, and potatoes

- On pages 196 and 205-207, authors state their opposition to the use of peanuts, canola oil, and potatoes for the following reasons:
  - Author’s claim regarding peanuts/peanut oil: Peanuts are atherogenic due to lectins (anti-nutrients)
- Kritchevsky et al. (1998) study on peanut oil atherogenicity in rabbits
  - Rabbits were fed a diet that had 6% peanut oil by weight, but also 2% cholesterol by weight
  - For a human consuming 2.14 kg food per day, a 2% cholesterol diet would be 42,800 mg/d (about 203 eggs/d at 210 mg cholesterol/egg)
- Wang et al. (1998) study on intact peanut lectin found in blood
  - Research letter in 7 healthy subjects (may not have been peer-reviewed)
  - As opposed to a “handful”, subjects were fed about half a jar (6.7 oz) of peanuts
    • 2 subjects ate raw peanuts, 5 had dry-roasted
  - Peak blood lectin (PNA) was <5 mcg/mL in all subjects, 1 had no response at all
    • All levels peaked between 1 and 4 h post-ingestion, back to zero by 24 h
    • Highly doubtful that level could have any biological effect

Silliness re: peanuts, canola and potatoes

- No evidence of atherogenicity of peanuts or peanut oil in humans
  - More likely cardiovascular benefits

- Canola oil (pp. 206-207):
  - Author’s claim: Cardiac toxicity of even today’s much lower concentrations of erucic acid in canola oil
    - Only studies that showed clinically significant adverse effects were in stroke-prone hypertensive rats or the Wistar Kyoto strain
      - No effects in normal Wistar rats
      - Rats fed turnip or oilseed rape at 10% by weight (not calories as implied in the book)
    - No human evidence of canola oil toxicity
  - Allergenicity
    - Children in these studies already had atopic dermatitis and multiple food allergies

Potatoes: Concerns regarding anti-nutrients that increase intestinal permeability

- 1 study cited
- Consisted of mainly in vitro studies of intestinal cells or tissues (IL-10 deficient mouse, not a normal mouse)
  - Mice already had enterocolitis!
- Feeding of isolated glycoalkaloids (solanine and chaconine) at supposedly physiological concentrations to IL-10 deficient mice
  - Aggravated colonic injury in mice (no effect in control mice)
- Again, no evidence of increased intestinal permeability in humans fed regular potatoes!
  - Solanine not a problem if you don’t eat green potatoes
    - Boiling removes solanine also (water-soluble)
    - Bitter taste typically limits ingestion before illness would develop

It is interesting that the book ignores anti-nutrients like oxalate and phytate that are found in many of the acceptable foods in the Paleo diet

Objection no. 6: Today’s longest living people don’t really eat a Paleo diet

- Buettner (2008) has explored several “Blue Zones”, which are geographical regions or populations in which the people have extraordinary longevity and vitality compared with other populations
  - Described dietary and lifestyle habits of the individuals
  - Four different regions/populations were identified: Sardinia, Southern California (Seventh Day Adventist), Okinawa, and Costa Rica (Nicoya region)

- Sardinia
  - Diet: Large amounts of bread (eaten while tending sheep), cheese (Pecorino from grass-fed sheep), onion, fennel, ravenelli, vegetable soup (minestrone), pasta, meat once per week to twice/month, little fish, daily wine (moderate), goat milk, mastic oil, beans, whole wheat, garden vegetables, fruits

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- **Okinawa**
  - Garden-grown vegetables (e.g., sweet potatoes, carrots, tomatoes, garlic, peppers, goya (bitter melon)) and herbs (mugwort, ginger, turmeric)
  - Soy (tofu, miso soup; avg. 3 oz./d)
  - Fish
  - Pork infrequently (ceremonial occasions)
  - Tea
  - Sun exposure for vitamin D

- **Southern California (Loma Linda, Seventh Day Adventist)**
  - Half are vegetarians or rarely eat meat
  - No alcohol, pork, or smoking (religious convictions)
  - Nuts
  - Lots of water
  - Fruits, vegetables, whole grains, peas, beans, tomatoes

Objection no. 6: Today’s longest living people don’t really eat a Paleo diet

- Costa Rica
  - Beans
  - Tortillas (corn)
  - Rice
  - Tropical fruit
  - Eggs and chicken
  - Calcium-rich drinking water
  - Coffee
  - Greens
  - Sun exposure for vitamin D

- Large meat intake not a factor in any of these diets
- Cereal grains are a large part of most of these diets

Paleo Diet for Athletes Summary

- There are several good things about the diet (high fruits and vegetables, lean meat for protein, less refined foods)
- However, there are several problems with the diet:
  - No science to support its use in athletes
  - Diet requires numerous exceptions at certain times during an athlete’s training and competition
  - Diet is nutritionally inadequate, expensive, and can present difficulties for long-term compliance
  - Authors’ philosophy on calcium balance and acid-ash hypothesis is not supported by the best scientific evidence
  - Authors’ views on peanuts, canola oil, and potatoes are based on misunderstandings of animal studies and misapplication of these findings to humans
  - Today’s longest lived people don’t eat the Paleo diet

- Questions??