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The Paleolithic Diet versus Modern Diet: You Are What Your Ancestors Ate

We've all heard conflicting ideas about what people should eat and what they should not. And if you scan the scientific literature, it's easy to find one nutrition study that contradicts another. So how do you figure out what people should really be eating?

To a great extent, our baseline diet can be found in evolutionary nutrition. Over the past decade or so, a small number of scientists has studied the composition of what has been called the paleolithic, stone-age, or cave-man diet. Their conclusion is that, over millions of years, humans and their primate ancestors ate a relatively consistent "natural" diet, despite geographical and climatological variations. Basically, people gathered and hunted their foods, instead of growing or manufacturing them.

What we, as a species, ate began to change around 10,000 years ago with the advent of agriculture and the widespread use of grains, milk, and domesticated livestock. Until that time, people consumed few grains and no milk beyond infancy – and no nonhuman milk, according to S. Boyd Eaton, MD, a radiologist-turned-medical-anthropologist. Over the past 50-75 years, the Western diet has undergone further and more accelerated changes. Yet our genes, which turn food into energy and tissue, are essentially those of cave men. The result amounts to a biological disconnect: our genes are not receiving the nutrition they were designed to work with and, consequently, they are more likely to malfunction and cause disease.

DIETARY FAT INTAKE NOW LOPSIDED

Artemis P. Simopoulos, MD, president of the Center for Genetics, Nutrition and Health, Washington, D.C., has focused on the fundamental roles that essential fatty acids, particularly the omega-6 ($\omega 6$) and omega-3 ($\omega 3$) families, play in health. The ratio of $\omega 6$ to $\omega 3$ in the modern diet, compared to the paleolithic diet (or even traditional high $\omega 3$ Greek and Japanese diets) is completely lopsided.

"Our current diet (Western diet) is characterized by an increase in total fat, saturated fat, trans fatty acids, and the $\omega 6$ essential fatty acids (EFA), but a decrease in the $\omega 3$ EFA," Simopoulos recently wrote. "The ratio of $\omega 6$ to $\omega 3$ fatty acids is 10-21/1, whereas during evolution it was 1/1 ... It is evident that today we have an imbalance in $\omega 6$ and $\omega 3$ EFA and practically a deficiency in $\omega 3$ fatty acid intake..."

The shift in fatty acid ratios came about because of what Simopoulos calls an "indiscriminate recommendation" by

public health authorities to substitute saturated fats with vegetable oils. Such oils are very high in $\omega 6$ fatty acids and very low in $\omega 3$ fatty acids. For example, corn oil has a $\omega 6:\omega 3$ ratio of 60 to 1 and safflower oil has a ratio of 77 to 1.

This imbalance tilts the body's production of immune compounds, such as hormone-like prostaglandins and cytokines, into a proinflammatory direction. Under the circumstances, it becomes easy to understand why taking $\omega 3$ fatty acids (in fish or flaxseed oils) eases inflammatory disorders – $\omega 3$ helps restore a balance of fatty acids.

But excessive $\omega 6$ fatty acids do more than just promote inflammation. Laboratory studies indicate that, calorie for calorie, animals are less likely to gain weight eating $\omega 3$ compared with $\omega 6$ fatty acids. In addition, many studies have found that $\omega 6$ -rich vegetable oils promote cancer cell proliferation, whereas $\omega 3$ inhibit it.

Compounding the problem, grain-fed animals develop a fatty acid profile high in saturated fats and $\omega 6$ but low in $\omega 3$. Meat from grass-fed or game animals has a more balanced fatty acid profile – and is much higher in $\omega 3$.

MODERN VITAMIN LEVELS LOW, TOO

Fats aren't the only foodstuff that has changed dramatically since prehistoric days. Eaton, who inspired interest in the paleolithic diet in the mid-1980s, has noted that vitamin intake today is much less than it was in prehistoric times. (His findings are based on paleontological data and studies of remaining stone-age cultures by anthropologists.) For example, he estimates the paleolithic intake of vitamin C to be 604 mg daily, whereas the average U.S. intake is 77-109 mg daily. Similarly, the paleolithic intake of vitamin E was 32.8 mg daily versus 7-10 mg today.

According to Eaton, modern intake of most other vitamins and minerals is substantially lower than in the past. The exception is sodium – 90 percent of which is added to foods. Furthermore, the evolutionary ratio favored high potassium. In the past, the potassium to sodium ratio was 13 to 1. It's now 1 to 1.5.

References: Simopoulos AP, "Overview of evolutionary aspects of $\omega 3$ in the diet," in Simopoulos AP (ed), *The Return of $\omega 3$ Fatty Acids into the Food Supply*. Basel: Karger: 1998, 1-11. Eaton SB, Eaton III SB, Konner MJ, "Paleolithic nutrition revisited: a twelve-year retrospective on its nature and implications," *European Journal of Clinical Nutrition*, 1997;51:207-216. □

Research summaries continue on next page

Live to 100? Antioxidants Might Help

How does a person make it to 100? Good genetics and a diet high in antioxidants may have some influence. And while it's too late to pick your parents, it's never too late to improve your diet.

In a recent study, Giuseppe Paolisso, MD, and his colleagues at the University of Naples, Italy, compared various measures of antioxidant status among 22 healthy centenarians, 30 subjects between the ages of 70 and 99, and 30 people less than 50 years old. Centenarians tended to be healthier than the 70-99 year olds, but not quite as healthy as those under age 50.

Paolisso measured the subjects' blood levels of vitamins E and C and the ratio of glutathione to oxidized glutathione. High levels of glutathione, an antioxidant, have been previously associated with longevity, whereas oxidized glutathione is a sign of "oxidative stress."

The centenarians ate substantially more vegetables than either of the other groups, and their ratio of glutathione to oxidized glutathione was nearly identical to those of the under-50 group. In addition, their blood levels of vitamins E and C were higher than subjects ages 70-99.

Markers of free radicals – malondialdehyde, thiobarbituric acid, and lipid hydroperoxides – were highest among subjects ages 70-99. Centenarians fared better, but not as well as those under 50. In addition, the centenarians had fasting glucose, free fatty acid, and insulin levels similar to those of subjects under age 50. High glucose, fatty acid, and insulin levels are associated with increased oxidative stress.

Paolisso concluded that "centenarians have a lower degree of oxidative stress than aged subjects. Difference in daily vegetable intake and in metabolic parameters might play a role."

Reference: Paolisso G, Tagliamonte MR, Rizzo MR, et al., "Oxidative stress and advancing age: results in healthy centenarians," *Journal of the American Geriatrics Society*, 1998;46:833-838. □

Vitamin B12, Folic Acid Reduce Chromosome Damage

As you age, your genetic material (DNA, genes, chromosomes) acquire damage and perform less efficiently. The sum of this damage is what we call aging, and it increases the risk of degenerative diseases, such as cancer, heart disease, and Alzheimer's.

While genetic damage is inevitable, it can be slowed down with supplements of just two B vitamins, folic acid and B12.

In a recent study, Michael Fenech, PhD, Australia's Commonwealth Scientific and Industrial Research Organization, took initial measurements of the rate of chromosome damage in the lymphocytes of 106 healthy

men and women, ages 18 to 35. He then divided them into two groups, giving some plain bran breakfast cereal or bran cereal fortified with 700 mcg of folic acid and 7 mcg of vitamin B12 (roughly 3.5 times the Australian recommended daily allowance) for three months. For another three months, participants were given tablets containing 10 times the RDA of folic acid and B12 or placebos.

Sixty-four of the subjects completed the study. (Many dropped out because they didn't like eating the cereal.) Those getting the extra folic acid and B12 in their cereal had substantially lower levels of chromosome damage. Vitamin B12 seemed most protective against chromosome damage. In addition, chromosome damage correlated with elevated homocysteine levels: the higher the homocysteine levels, the greater the chromosome damage.

In addition, vitamin B12 was inversely correlated with chromosome damage: the higher the B12 levels, the less the chromosome damage. However, very high doses of folic acid and B12 had no additional benefit, at least not among healthy young adults.

"The results from this study have implications relating to the reduction of cancer risk and possibly ageing if one takes into account the potential role that chromosome damage rate has in these two processes," Fenech wrote in *Carcinogenesis*.

Reference: Fenech M, Aitken C, and Rinaldi J, "Folate, vitamin B12, homocysteine status and DNA damage in young Australian adults," *Carcinogenesis*, 1998;19:1163-1171. □

Vitamin B6 May Protect Heart

Low blood levels of vitamin B6 indicate a high risk of coronary heart disease, according to a new study by Aaron R. Folsom, MD, of the the University of Minnesota, Minneapolis.

Folsom tracked the health of 759 middle-age subjects who were free of heart disease when they joined the study. Three years later, Folsom found that people later diagnosed with heart disease had higher blood levels of homocysteine and lower levels of folic acid, vitamin B6, and vitamin B12, and generally did not take supplements.

The most significant risk factor, however, was low vitamin B6 levels. Conversely, people with the highest B6 levels had one-third the risk of developing heart disease, according to Folsom's article in *Circulation*.

In this study, women with elevated levels of homocysteine were at greater risk of heart disease, but men were not. Homocysteine is a byproduct of protein metabolism that damages blood vessel walls.

Reference: Folsom AR, Nieto FJ, McGovern PG, "Prospective study of coronary heart disease incidence in relation to fasting total homocysteine, related genetic polymorphisms, and B vitamins," *Circulation*, 1998;98:204-210. □

Vitamin C Improves Tolerance to Heart Drug Nitroglycerine

The drug nitroglycerin is commonly prescribed for the treatment of angina. Although the drug dilates blood vessel walls and increases blood circulation within the heart, prolonged use of it and other "nitrate" drugs results in nitrate tolerance – that is, the body becomes tolerant of the drug and its effects wear off.

It turns out that vitamin C supplements can prevent nitrate tolerance and, thereby, increase the usefulness of such drugs as nitroglycerine.

Eberhard Bassenge, PhD, and his colleagues at the University of Freiburg, Germany, tested the effects of nitroglycerine (glyceroltrinitrate) on nine healthy subjects. Some were given nitroglycerine and 3,000 mg of vitamin C daily, others took nitroglycerine and a placebo, and still others took a placebo and vitamin C daily for three days.

The two groups taking nitroglycerine responded to the drug. Subjects taking vitamin C with the drug continued to respond to nitroglycerine, but those not taking the vitamin had a declining response to nitroglycerine.

Earlier research by Bassenge and his team suggested that nitroglycerine increases production of superoxide free radicals. They decided to try vitamin C because of its ability to quench free radicals.

Reference: Bassenge E, Gink N, Skatchkov M, et al., "Dietary supplement with vitamin C prevents nitrate tolerance," *Journal of Clinical Investigation*, 1998;102:67-71. □

The Benefits of Nutrients: More Than You Can Measure in the Blood

Of the estimated 50 carotenoids and several hundred flavonoids in the diet, relatively few can be measured in the bloodstream. Does that mean all the others are worthless?

Not necessarily. Some researchers have argued that foodstuffs can switch on immune cells that line the gastrointestinal tract, which in turn activate other immune cells throughout the body.

Take the case of dietary fiber as an example. Fiber hastens the movement of food through the intestine, reducing the time carcinogens can cause trouble. It reduces the risk of diverticulosis and colon cancer. It lowers blood cholesterol levels. But fiber is not absorbed.

In recent research, Richard A. Hodin, MD, of the Harvard Medical School, showed that fiber turns on an important anticancer gene. As fiber moves through the intestine, bacteria ferment it and produce butyrate, a compound that inhibits colon cancer cells. Butyrate works by turning on the gene that codes for the p21 protein, which subsequently turns off a gene involved in proliferating colon cancer cells. All this happens, of course, without fiber being absorbed.

The lesson? Many physicians and researchers hold the view that nutrients cannot play a role in health unless they are absorbed into the bloodstream. But there's more to nutrition than what can be measured in the blood. No absorption does not mean no benefits.

Reference: Archer SY, Meng S, Shei A, et al., "p21 WAF1 is required for butyrate-mediated growth inhibition of human colon cancer cells," *Proceedings of the National Academy of Sciences of the USA*, 1998;95:6791-6796. □

Folic Acid Deficiency Often Ignored

Just how common is folic acid deficiency? Christopher S. Probert, MD, of the Bristol Royal Infirmary, England, found that folic acid deficiencies were not always treated at his hospital.

Probert analyzed 84 elderly hospital patients with low red blood cell levels of folic acid. Of these patients, only 32 (38 percent) were given a clear diagnosis of folic acid deficiency. Sixteen cases were related to dietary deficiencies, and nine others had drug-induced deficiencies.

"Perhaps most worrying were the 28 patients (33.3%) whose deficiency seems to have been ignored; these patients were neither investigated nor offered folate supplements," Probert wrote.

He added that the situation was unlikely to be unique. "Underinvestigation of folate deficiency is probably a national problem and it needs to be taken more seriously," he added.

Reference: Haslam N and Probert CS, "An audit of the investigation and treatment of folic acid deficiency," *Journal of the Royal Society of Medicine*, 1998;91:72-73. □

Studies Find Echinacea Eases Cold Symptoms, Boosts Immune System

The herb echinacea is one of the most popular natural remedies for boosting resistance to colds and flus and for easing their symptoms. And according to a recent double-blind trial, it works.

Rosemary M. Brinkeborn, MD, of the University Hospital, Uppsala, Sweden, gave either echinacea supplements (800 mg three times daily) or a placebo to 119 patients at the onset of cold symptoms.

The subjects and the examining physician in the study assessed 12 cold symptoms, including cough, headache, burning eyes, sore throat, and stuffy or running nose. It turned out that echinacea was twice as effective as the placebo in relieving cold symptoms, and 78 percent of the patients taking echinacea reported an improvement in their symptoms. The examining physician estimated that echinacea benefited 68 percent of the patients.

In the treatment of colds, echinacea was "clearly superior to placebo in terms of efficacy," Brinkeborn and her colleagues wrote.

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Quick Reviews of Recent Research

• Honey of an antioxidant

In an analysis of 19 samples of honey from 14 types of blooming plants, researchers found that darker-colored honeys contained more antioxidants than lighter honeys. Honey from Illinois buckwheat had 20 times more antioxidants than honey from California sage. The antioxidants are primarily polyphenolic flavonoids, plus traces of vitamins C and E and beta-carotene.

Frankel S, et al., *Journal of Apicultural Research*, 1998;37:27-31.

• Lutein associated with lower heart risk

Researchers studied the relationship between diet and thickness of the carotid intima-media in 307 middle-age women and men. A thicker intima-media, which consists of cells in a major blood vessel wall, is associated with coronary heart disease. Higher levels of lutein and zeaxanthin were associated with a thinner intima-media and a reduced risk of heart disease.

Dwyer JH, et al., *Circulation*, 1998;97:829 (Abstract P61).

• Lutein inhibits breast cancer cells

In a cell culture study, researchers tested the effects of lutein and zeaxanthin on MCF-7 breast cancer cells. The combination of carotenoids significantly suppressed cell division. Lutein, a common dietary carotenoid, is found in kale and broccoli, and zeaxanthin is found in cress leaf and okra.

Milo L, et al., *FASEB Journal*, 1998;12:A830 (Abstract 4810).

• Oxidized cholesterol promotes heart disease

Oxidized cholesterol is an early step in the development of coronary heart disease. The cholesterol is engulfed by white blood cells, which then infiltrate artery walls. Many forms of oxidized fats are found in the diet, such as in french fries and other fried foods. In previous studies, researchers found that oxidized dietary fatty acids increased the risk of heart disease. In this study, using rabbits, researchers found

that oxidized dietary cholesterol increased levels of oxidized cholesterol levels in the rabbits. Non-oxidized cholesterol did not increase levels of oxidized cholesterol.

Staprans I, et al., *Arteriosclerosis, Thrombosis and Vascular Biology*, 1998;18:977-983.

• High-Fructose Sweeteners Bad for Bones

Researchers placed 11 healthy men on a low-magnesium diet with large amounts of fructose in the form of five daily cans of soft drinks sweetened with high-fructose corn syrup. The diet resulted in a low "magnesium balance" in the men. It also suppressed calcium and phosphorus levels. All three minerals are needed for maintaining healthy bones.

Milne DB and Nielsen FH, the Federation of American Societies for Experimental Biology meeting, San Francisco, April 1998.

• Silymarin curbs growth of skin cancer cells

In a laboratory study, researchers exposed skin cancer cells to silymarin, an antioxidant complex found in the herb milk thistle. Silymarin inhibited the growth of skin cancer cells. It appeared that silymarin worked by inhibiting "epidermal growth factor receptor," which can promote the growth of skin cancer.

Ahmad N, et al., *Biochemical and Biophysical Research Communications*, 1998;247:294-301.

• NAC speeds recovery from septic shock

Septic shock often follows sepsis, an infection of the blood, and is characterized by a life-threatening drop in blood pressure. It's a leading cause of death among patients in hospital intensive care units. Doctors gave oral and intravenous N-acetylcysteine (NAC) to 12 patients within four hours of being diagnosed with septic shock; they compared the patients' responses to 10 who did not receive NAC. While NAC did not influence the risk of death, it did speed recovery. Patients getting NAC required less ventilator breathing support and were discharged in one-third the time of patients not getting NAC.

Spapen H, et al., *Chest*, 1998;113:1616-1624.

Echinacea Eases Colds...

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In a separate study, researchers at Utah State University, Logan, tested the effect of fresh and dried echinacea "juice" on macrophages, a type of white blood cell. The researchers cultivated macrophages, then exposed them to the fresh or dried echinacea. Levels of various cytokines—immune compounds that help fight infections—increased in the macrophages mixed with echinacea.

References: Brinkeborn R, Shah D, Geissbühler, et al., "Echinaforce® in the treatment of acute colds," *Schweizerische Zeitschrift für Ganzheits Medizin*, 1998;10:26-29. Burger RA, Torres AR, Warren RP, "Echinacea-induced cytokine production by human macrophages," *International Journal of Immunopharmacology*, 1997; 19: 371-379. □

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