leafy parts of fresh grasses and legumes, where so many vitamins and antioxidants are created. Nonruminants, like chickens and pigs, benefit from fresh greens, seeds, worms, insects and other rich food sources while grazing. Beta-carotene (bright orange in color, masked by green chlorophyll) is produced by plants and stored in the fat of pastured animals. Their fat is yellow, not white. Exposure to sunlight increases production of naturally occurring vitamin D.

Milk, cheese and butter from grass-fed cows have been found to be higher in Vitamin A, D, E and betacarotene. The natural golden color of grass-fed butter, yogurt and cheese is an indication of its nutritional value.^v

Grass-fed beef is 4 times higher in vitamin E.vi An Ohio State University study found that pigs raised on pasture have 300% more vitamin E and 74% more selemium.vii Meat from sheep raised on pasture contains twice as much lutein.viii

According to a 2007 study, pastured eggs contain 2/3 more vitamin A, 7 times more beta-carotene and 3 times more vitamin E.^{IX} Egg yolks are also the richest known source of lutein (another carotenoid) —the firmer and deeper yellow-orange color of yolks, the more of these important nutrients.^X Grass-fed eggs still contain 30 times more vitamin E. In addition, because pastured hens are exposed to sunlight, their eggs are also 3 to 6 times higher in



vitamin D. ×i

GrassWorks is a membership organization that provides leadership and education to farmers and consumers for the advancement of managed grass-based agriculture to benefit present and future generations. For more information: www.grassworks.org





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More Vitamins and Disease-Fighting Antioxidants

How Grass Farmers Make Quality & Nutritious Food Using Managed Grazing



Many of us have a strong desire for good health. Dietary supplements and foods containing added ingredients, such as cereals and energy drinks fortified with vitamins, are growing multibillion dollar industries in the United States. In 2007, sales of dietary supplements alone reached approximately \$23.7 billion.¹ Sixty-eight percent of Americans, according to the industry, take a multivitamin as "insurance to offset poor diets."¹¹ The more we learn about nutrition and how different components work in the human body, the clearer the answer becomes: A balanced diet of nutrient-dense foods is the best way to maintain and improve health.

Managed Grazing

A new generation of farmers is producing nutrientdense, great-tasting food by raising animals on pasture using managed grazing. Managed grazing is a sustainable farming method in which beef and dairy cattle, sheep, hogs, poultry, goats and/or bison are rotated through paddocks of high quality grasses and legumes to cycle harvest and rest for re-growth. Managed grazing mimics natural processes to maximize soil health, the basis of the food system. Diverse pasture plants draw minerals from the soil and capture energy from the sun to create a complex of vitamins, carotenoids, fatty acids and other essential components. Animals graze the nutritious leafy parts of forage plants that, in turn, affect the



quality of the meat, eggs and milk that nourish us and our families. Animal manure returns organic matter back to the soil, which provides nutrients for the plants.

The complex nutritional goodness we humans need is manufactured by the living plants that turn sunlight into food. Vitamin B₁₂ (µg Vitamin C (mg) Vitamin A (µg F Vitamin D Vitamin E Vitamin K (µg) Calcium (mg) Phonghorma (mg)

odate (ug)

Vitamins and Antioxidants

Vitamins are divided into two groups: water-soluble (B-complex and C) and fat-soluble (A, D, E and K). Unlike water-soluble vitamins that need regular replacement in the body, fat-soluble vitamins are stored in the liver and fatty tissues and are eliminated much more slowly than water-soluble vitamins. Fatsoluble vitamins are essential for maintaining good health. Deficiencies can lead to a wide range of acute maladies and can increase risks of disease. Foods that contain these vitamins will not lose them when cooked.

Antioxidants are present in foods as vitamins, carotenoids, minerals, polyphenols and other components. Oxidation, or the loss of an electron, can sometimes produce reactive substances known as "free radicals" that can cause stress or damage to the cells. Antioxidants can stabilize these free radicals before they cause harm. Because oxidation is a naturally occurring process within the body, a balance with antioxidants must exist to maintain health.

Vitamins and antioxidants that have been shown to occur in larger amounts in grass-fed products include:

• Vitamin A is an antioxidant that protects cells from destruction. It is important for vision, for

healthy skin and mucus membranes and for development of strong bones and teeth.

- Beta-carotene (pro-vitamin A), also a potent antioxidant, provides a source of vitamin A, enhances immune system, helps the reproductive system function properly and may protect against cancer.
- Lutein is an antioxidant related to betacarotene. It reduces the risk of macular degeneration (a leading cause of blindness), improves skin health and may help prevent breast and colon cancer.^{III}
- Vitamin D plays a critical role in the body's use of calcium and phosphorous. It increases calcium absorption and helps form and maintain bones and teeth.
- Vitamin E acts as an antioxidant, protecting vitamins A and C, red blood cells and essential fatty acids from destruction.
 Vitamin E deficiencies have been linked with diabetes, auto-immune disorders, AIDS, muscle damage during exercise, Parkinson's disease, eye disease and lung and liver diseases.
- **Selenium** is a mineral that acts as an antioxidant by protecting cells from damage by free radicals.

Grass-Fed Has the Good Stuff

In an managed grazing pasture, animals eat nutrient-dense forage that has high bioavailability and is appropriate for their digestive systems. As a result, they produce food that is more nutrient dense. Ruminants were built to digest the green

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