Editorial Background Information

Grass-Fed Beef and Health

The following information is excerpted from a June 2005 study of Panorama Grass-Fed Beef conducted by Cynthia A. Daley, PhD, College of Agriculture, California State University, Chico, Calif.

To read the complete scientific study, visit
http://www.csuchico.edu/agr/grassfedbeef/health-benefits/index.html

Grass-fed beef, or beef produced from cattle finished on forage only diets, has been touted as a more nutritious beef product. There are a number of reports that show grass-fed beef products contain elevated concentrations of beta-carotene and a-tocopherol, increased levels of omega-3 fatty acids, a more desirable omega-3:omega-6 ratio, and increased levels of conjugated linoleic acid (CLA), all substances reported to have favorable biological effects on human health.

Nutrients in Grass-fed Beef

ProVitamin A: Beta-Carotene
Beta-carotene, a fat-soluble antioxidant, is derived from the Latin name for carrot, which belongs to a family of natural chemicals known as carotenes or carotenoids. Carotenes produce the yellow and orange color found in fruits and vegetables and is converted to vitamin A (retinol) by the body. Vitamin A is a critical fat-soluble vitamin that is important for normal vision, bone growth, reproduction, cell division, and cell differentiation.

Pasture-fed steers incorporated significantly higher amounts of beta-carotene into muscle tissues as compared to grain-fed animals. Concentrations ranged from 0.63 – 0.45 µg/g and 0.06 – 0.5 µg/g for meat from pasture and grain-fed cattle respectively, a 10-fold increase in beta-carotene levels for grass-fed beef.

Vitamin E: Alpha-tocopherol
Vitamin E is also a fat-soluble vitamin that exists in eight different forms with powerful antioxidant activity, the most active being a-tocopherol. Antioxidants protect cells against the effects of free radicals. Free radicals are potentially damaging by-products of the body's metabolism that may contribute to the development of chronic diseases such as cancer and cardiovascular disease.

The concentration of natural a-tocopherol (vitamin E) found in grain-fed beef is approximately 2.0 µg/g of muscle whereas pasture fed beef ranges from 5.0 to 9.3 µg/g of tissue depending on the type of forage made available to the animals.. Forage finishing increases a-tocopherol levels 3-fold over conventional beef and well within range of the muscle a-tocopherol levels needed to extend the shelf-life of retail beef.

Omega 3: Omega 6 fatty acids
Omega-3 fatty acids are considered essential fatty acids, which means that they are essential to human health but cannot be manufactured by most mammalian species. For this reason, omega-3 fatty acids must be obtained from food.

Essential fatty acids (EFAs) are polyunsaturated and grouped into two families, the omega-6 EFAs and the omega-3 EFAs. Although there are just minor differences in their molecular structure the two EFA families act very differently in the body. While the metabolic products of omega-6 acids promote inflammation, blood clotting, and tumor growth, the omega-3 acids act entirely opposite. However, it is important to maintain a balance of omega-3 and omega-6 in the diet as these two substances work together to promote health.

A healthy diet should consist of roughly one to four times more omega-6 fatty acids than omega-3 fatty acids. The typical American diet tends to contain 11 to 30 times more omega-6 fatty acids than omega-3 and many researchers believe this imbalance is a significant factor in the rising rate of inflammatory disorders in the United States.

There is some consensus among leading nutritionists who consider increases in chronic disease as no accident; they believe it is directly related to the change in our dietary patterns over the last 200 years. Our ancestors lived on an omega-6:omega-3 ratio of 1:1, while our current dietary habits are closer to 10-20:1. Researchers believe the ideal omega-6 intake should be no more than 4-5 times that of our omega-3 intake.

As with the human diet, cattle feed or the composition of the ration has a significant effect on the fatty acid profile of the final beef product. *Cattle fed primarily grass enhanced the omega-3 content of beef by 60% and also produces a more favorable omega-6 to omega-3 ratio. Conventional beef contains a 4:1 omega 6:3 ratio while grass-only diets produce a 2:1 omega 6:3 ratio*.

In general, grass-fed cattle are slaughtered at lighter weights than grain fed beef, producing *leaner (lower fat) carcasses overall*. Leaner carcasses have the advantage of an overall lower percent fat and a higher proportion of favorable unsaturated fatty acids.

Conjugated Linoleic Acid (CLA)

The term conjugated linoleic acid and its acronym CLA is a group of polyunsaturated fatty acids found in beef, lamb, and dairy products that exist as a general mixture of positional and geometric conjugated isomers of linoleic acid. These compounds are produced in the rumen of cattle and other ruminant animals during the microbial biohydrogenation of linoleic and linolenic acids by an anaerobic rumen bacterium Butyrivibrio fibrisolvens.

Over the past two decades numerous health benefits have been attributed to CLA in experimental animal models including actions to reduce carcinogenesis, atherosclerosis, onset of diabetes, and fat body mass. CLA is found naturally in a variety of ruminant meats and dairy products.

On average, grass-fed beef will provide approximately 123 mg of CLA for a standard hamburger at 10% fat. The same hamburger produced from grain-fed beef would provide 48.3 mg. (i.e., grass-fed = 1.23 g CLA/ 100g lipid; 12.3 mg/g lipid; 10% lipid/serving = 123 mg CLA).

Research to date would support the argument that grass-fed beef is higher in Vitamin A, Vitamin E, CLA and Omega 3 when lipids are compared on a gram of fatty acid/gram of lipid basis.

Maintaining the favorable lipid profile
Maintaining the favorable lipid profile in grass-fed beef requires a high percentage of forages, the more green and fresh the forage, the higher the C18:2 a-linoleic and a-linolenic acid precursor will be available for n-3 and CLA synthesis. Dried, cured forages will have a lower amount of precursor, with a slightly lower level of functional lipids in the final product.

To maintain high functional lipid concentrations, producers must feed forages rich in C18:2 is to maintain a high concentration of pre-curser compounds in the ration. The precursor for the n-3 series is a-linolenic (LNA: C18:3 n-3), the higher the concentration of C18:3 n-3 in the ration, the more n-3 fatty acids will be found in the final product. *Fresh forages have 10 to 12 times more C18:3 than cereal grains (French, et al., 2003). Likewise, the precursor fatty acid for CLA is linoleic acid (LA: C18:2n-3), the higher the concentration LA the diet, the higher the concentration of CLA in the meat.*

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Dr. Cynthia A. Daley completed her BS in Animal Science at the University of Illinois and her Ph.D. at the University of California, Davis in Endocrinology where she published her work on the effect of stress on gene expression. In 1998, Daley accepted the Animal Biotechnologist position at CSU, Chico College of Agriculture, where she continues to develop her research in assisted reproductive technologies.

Among Daley's most recent awards is the 2002 AASCARR Outstanding Teacher Award; 2002 Rotary International Educator Recognition Award; 2002/03 Outstanding Professor Award; Golden Key Honor Society Honorary Membership Award for pursuit of academic excellence in the classroom; the California Agriculture Teachers Association Silver Teaching Award for having a significant impact on young Ag teachers in training; the Professional Development Award from the Office of Sponsored Programs for significant contributions to the field of study; and the Maggie Award for outstanding service to young women at California State University, Chico.