

VIII. Emerging Health-Promoting Components in Beef

Beef is known as a source of “traditional” nutrients, but research is discovering evidence of additional health-promoting components. Emerging science indicates that nutrients in beef, such as conjugated linoleic acid (CLA), selenium and choline, may be effective in promoting health and cognitive development.

In vitro and experimental animal studies reveal that CLA plays a role in disease prevention and favorably affects body composition. Emerging work with humans and animals suggests that selenium may reduce the risk of cancer and possibly heart disease. Studies with animal models suggest that choline plays a unique role in memory development and cognition. Although these findings of potential health-promoting components in beef are promising, conclusive evidence has yet to be demonstrated in humans.

CONJUGATED LINOLEIC ACID (CLA)

CLA, a derivative of the essential fatty acid, linoleic acid, is naturally found in ruminant animal sources such as beef, lamb and dairy products.¹ CLA has been demonstrated to have anti-carcinogenic, anti-atherogenic and anti-diabetic properties, enhance immune response, and have positive effects on body composition (i.e., increase the ratio of lean body tissue to body fat).¹⁻⁴

CLA and linoleic acid are similar in structure, both being 18 carbon double bonded fatty acids. However, these fatty acids differ in the position and configuration of the double bonds.¹ This very subtle change in structure gives CLA its unique biological effects. CLA contains mixtures of different isomers which may exert different functions.^{1,3} Numerous CLA isomers are found in beef, however, the cis-9, trans-11 isomer is the principal form of CLA in beef and in the overall diet.^{1,3}

Multi-Site Anti-carcinogen

Unlike linoleic acid, which in some studies stimulates tumor growth and metastases, CLA inhibits tumor growth and development.^{1,6} In vitro and experimental animal studies demonstrate that CLA inhibits specific cancers, including those of the skin, stomach, mammary gland, colon, and prostate.^{1,5} The discovery of CLA's anti-carcinogenic effect arose from identification of a fraction in ground beef with cancer preventive activity.⁵ In a series of experiments in rats, CLA has been shown to inhibit chemically-induced mammary tumors at various stages of cancer, regardless of the amount or type of dietary fat.⁷ CLA at levels as low as 0.1% in the diet produces a significant reduction in mammary tumor yield in animal studies.⁸ Research with a wide variety of animal models, cell cultures and cancer cell lines is underway to identify the effective dose and specific isomer(s) of CLA responsible for its anti-carcinogenic effects.

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Anti-Atherogenic Properties

Lower total cholesterol, LDL cholesterol, and triglyceride levels were found in the blood of CLA-fed hamsters than in control animals. Also, CLA reduced early aortic atherosclerosis in cholesterol-fed hamsters.⁹ In rabbits, feeding CLA at levels as low as 0.1% inhibited atherogenesis.¹⁰ Further, at levels of 1% of the diet, CLA caused a 30% regression of established atherosclerosis.¹⁰

Body Composition

Studies in young growing animals indicate that CLA favorably affects body composition by decreasing body fat and increasing lean muscle.^{11,12} Research indicates that the 10-12 isomer of CLA, found in beef but at lower levels than the 9-11 isomer, is the active form for this particular effect on body composition.^{11,12}

CLA may influence body composition, at least in part, by modulating the immune system and affecting cytokines.³ Cytokines are hormone-like mediators of immunity and inflammation which can cause the breakdown of muscle tissues. CLA can decrease the production of cytokines,

thereby preventing muscle degradation. This may also have positive effects on bone health. Diets rich in fats containing CLA have been shown to increase the rate of bone formation in rats.^{1,13}

Anti-Diabetes Effect

CLA has been found to help normalize or reduce blood glucose levels and possibly prevent diabetes in animal models.^{1,2,14} CLA appears to work as well as a new class of diabetes management drugs (thiazolidinediones) and may provide the added advantage of weight reduction, as these drug treatments often result in weight gain.

As a better understanding of CLA's biologically active forms, efficacy levels and mechanism of action emerges, natural food products with enhanced CLA levels may serve as prototypes for a new generation of functional foods that provide a health benefit beyond basic nutrition. The American Dietetic Association, in its position paper on functional foods, recognizes beef, lamb and dairy foods as functional foods due to their CLA content.¹⁵

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SELENIUM

Selenium is a trace mineral that aids in the production of glutathione peroxidase, an enzyme that serves as a natural antioxidant.¹⁶ Studies have found that selenium may reduce the risk of certain types of cancer and possibly heart disease.^{16,17}

Beef is an excellent source of selenium. A 3-ounce serving provides 30% of the selenium RDA for adult men and women.^{16,18} The RDA for selenium for adults is 55 mcg/day.¹⁶

Animal foods and seafood generally contain more selenium than do plant foods.^{16,18} Consequently, vegetarians, especially those who avoid all animal food products, tend to consume less selenium than individuals who include animal food products such as meat in their diets.¹⁶ Selenium deficiency is virtually nonexistent in free-living healthy individuals in the U.S.

Chemopreventive Properties

Selenium in excess of recommended intakes may have an anticancer effect, according to laboratory animal and human studies.^{16,17} One epidemiological study found that the risk of prostate cancer was one-third less in men receiving 200 mcg selenium/day than in men receiving the placebo. It is important to note that this study used a dose of selenium almost four times the RDA. Even

though the study dose falls below the Tolerable Upper Intake Level of 400 mcg selenium/day for adults, doses higher than the RDA should be taken only under medical supervision. Further research needs to be conducted before higher selenium intakes can be recommended for protection against cancer in humans.

Cardiac Health

Some early studies suggested a beneficial role for selenium in cardiac health.¹⁷ Low blood levels of selenium have been associated with myocardial infarction and increased cardiovascular disease mortality.¹⁷ Selenium deficiency may enhance blood clot formation, whereas adequate selenium status may protect blood vessel endothelial cells from damage by oxidized low-density lipoproteins.¹⁷

CHOLINE

Memory and Cognition

Choline is a nutrient that is an essential building block for the memory forming brain chemical, acetylcholine, which is used in the transmission of impulses between nerves, muscles and organs. In this role, choline and its metabolism are involved in cognition, long- and short-term memory and stimulus responses.¹⁹ The importance of adequate choline intake during pregnancy is illustrated in studies in animals.¹⁹⁻²¹ Prenatal choline deficiency may

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cause significant alterations to specific memory centers of the brain by reducing cell division, changing cell migration and increasing the number of cells that die prematurely.²⁰ Other studies in animals suggest that adequate intake of choline during pregnancy may enhance an offspring's lifelong cognition and memory.^{19,21}

The Food and Nutrition Board of the National Academy of Sciences has designated choline as an essential nutrient.²² Adequate intake levels for choline are set at 425 mg/day for adult women and 550 mg/day for adult men. Due to choline's important role in fetal cognitive

development, adequate intake levels for women are increased during pregnancy and lactation to 450 and 550 mg/day, respectively.²² Foods with significant amounts of choline and choline esters include beef liver, eggs, peanuts and iceberg lettuce.²³

Nutrition science is a dynamic field. As more is learned about the functional properties of food, including beef, the role of diet in good health may change. More well-designed, controlled, long-term human studies are needed before generalized statements regarding a nutrient's or food's functional role can be made.

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