

What Science Says About Beef: A Nutrient-Rich Source of High-Quality Protein

PROTEIN

Dietary Guidance Should Recognize Benefits of Protein

Acknowledging that by 2040 there will be 1.3 billion people 65 and older, accounting for 14 percent of the total global population, this editorial in *Nutrition & Metabolism* suggests the 2010 *Dietary Guidelines* should address a number of age-related problems including obesity, osteoporosis, type 2 diabetes, metabolic syndrome, heart disease and sarcopenia. A growing body of research supports that protein is a critical part of the adult diet and demonstrates that consuming 30 grams of protein at each meal is important to maintain body composition, bone health and normal blood sugar. According to the author, the 2010 *Dietary Guidelines* need to recognize the benefits associated with moderate protein intake and emphasize the right amount of protein at each meal. Layman DK. *Dietary Guidelines* should reflect new understandings about adult protein needs. *Nutrition & Metabolism*. 2009; 6:12.

Muscle

Optimize Muscle Strength and Improve Overall Health with High-Quality Protein

A recent research review indicated that increasing daily high-quality protein intake may optimize muscle strength and metabolism, and ultimately improve overall health. A growing body of evidence suggests muscle metabolism may also play a role in the prevention of many chronic diseases, such as type 2 diabetes and osteoporosis. Eating at least 15 grams of essential amino acids at each meal, equivalent to four ounces of a high-quality protein like lean meat, may help maintain muscle mass, and provide strength to lead an active lifestyle.¹

Wolfe, R. The underappreciated role of muscle in health and disease. *American Journal of Clinical Nutrition*. 2006; 84:475-82.

Americans Need More Protein to Maintain Muscle Mass as They Age

Sarcopenia, the slow loss of muscle mass, strength and endurance which begins in a person's mid-40's, is associated with a three- to four-fold increased likelihood of disability, and cost the United States healthcare system \$18.5 billion in 2000. A body of evidence reviewed by leading protein researchers concludes that protein intakes greater than current Dietary Reference Intake (DRI) of 0.8g/kg/d may enhance muscle protein development and reduce progressive loss of muscle with age.

Paddon-Jones D, Short K, Campbell W, Volpi E, Wolfe R. Role of dietary protein in the sarcopenia of aging. *American Journal of Clinical Nutrition*. 2008; 87 (suppl): 1562S-6S.

Lean Beef Protein Enhances Muscle Development

A research study, "Aging Does Not Impair the Anabolic Response to a Protein-Rich Meal," examined the role of beef in stimulating muscle growth in older Americans, which is critical to helping people avoid bone fractures, and live well and independently as they age. The study found that consuming four ounces of lean beef protein can help enhance muscle development by 50 percent. These results suggest that consuming an adequate amount of lean protein can lead to an improved ability to increase or maintain muscle mass, and as a result, may delay the onset of sarcopenia or loss of muscle.

Symons T, Schutzler S, Cocke T, Chinkes D, Wolfe R, Paddon-Jones D. Aging does not impair the anabolic response to a protein-rich meal. *American Journal of Clinical Nutrition*. 2007; 86:451-6.

Protein: Key Player in Prevention of Rising Public Health Issue

Dietary interventions can combat the loss of lean muscle mass with aging, also known as sarcopenia. Research shows that 25 – 35 grams of high-quality protein per meal is the optimal amount of protein that should be consumed to preserve muscle mass with aging. This protein recommendation is consistent with current dietary guidance.²

Paddon-Jones D, Rasmussen BB. Dietary protein recommendations and the prevention of sarcopenia. *Current Opinions in Clinical Nutrition & Metabolic Care*. 2009; 12(1):86-90.

¹ A 3-ounce serving of lean beef provides 25.4 grams of protein or 51 percent of the Daily Value.

² The optimal amount of high-quality protein (25 - 35 grams) is equivalent to four ounces of lean beef

Weight Management

Protein Aids in Weight Management and Satiety

A body of research discussed by 52 international protein researchers suggests protein may play a key role in several aspects of weight management. Evidence suggests that a moderate increase in dietary protein in association with physical activity and a calorie-controlled diet may aid with weight management by increasing thermoneogenesis, which influences satiety and augments energy expenditure, helping maintain lean muscle mass and improve metabolic profile.

Paddon-Jones D, Westman E, Mattes R, Wolfe R, Astrup A, Westerterp-Plantega M. Protein, weight management, and satiety. *American Journal of Clinical Nutrition*. 2008; 87 (suppl): 1558S-61S.

Satisfy Hunger with High-Quality Protein

Numerous studies have shown that dietary protein is more satiating than carbohydrates and fat. A study, "Inadequate Dietary Protein Increases Hunger and Desire to Eat in Younger and Older Men," published in the *Journal of Nutrition* showed that protein intake below the DRI (0.75 g/kg/d and 0.50 g/kg/d) can lead to increased hunger and a desire to eat among men.³

Apolzan JW, Carnell NS, Mattes RD, Campbell WW. Inadequate Dietary Protein Increases Hunger and Desire to Eat in Younger and Older Men. *Journal of Nutrition*. 2007;137(6):1478-82.

Optimal Health

High-Quality Protein Promotes Optimal Health

A review article assessed protein quality and dietary recommendations and found increasingly complex roles for protein and amino acids including regulating body composition and bone health; gastrointestinal function and bacterial flora; and satiety. The research report found protein quality is as important as adequate quantity to achieve optimal health. Animal protein foods such as beef, pork, eggs, fish, poultry and dairy products are essential sources of high-quality protein. There is strong evidence of a positive role for high-quality protein in promoting optimal health at intakes beyond the DRI of 0.8 g/kg/d.

Millward D, Layman D, Tomé D, Schaafsma G. Protein quality assessment: impact of expanding understanding of protein and amino acid needs for optimal health. *American Journal of Clinical Nutrition*. 2008; 87 (suppl): 1576S-81S.

Heart Health

Moderate Protein Diet Improves Weight Management and Heart Health

Research indicates that obese adults can lose weight and decrease their risk for metabolic syndrome and type 2 diabetes by following a moderate-carbohydrate, moderate-protein diet (carbohydrate ~40%; protein ~30%; fat ~30% of calories). Individuals on the moderate-protein diet reduced their body fat and improved blood lipid levels (decreased triglycerides and increased HDL).⁴

Layman DK, Evans EM, Erickson D, Seyler J, Weber J, Bagshaw D, Griel A, Psota T, Kris-Etherton PK. A Moderate-Protein Diet Produces Sustained Weight Loss and Long-Term Changes in Body Composition and Blood Lipids in Obese Adults. *Journal of Nutrition*. 2009; 139:514-521.

Improve Heart Health and Insulin Sensitivity with High-Quality Protein

A randomized clinical trial evaluated the metabolic effects of two weight loss diets and found that a moderate-carbohydrate, moderate-protein diet (carbohydrate ~40%; protein ~30%; fat ~30% of calories) helped individuals lose more weight and reduce their risk factors for metabolic diseases including type 2 diabetes, compared to those who followed a high-carbohydrate, low-protein diet. The moderate-protein diet group also reduced their risk factors for cardiovascular disease.

Lasker DW, Evans EM, Layman DK. Moderate carbohydrate, moderate protein weight loss diet reduces cardiovascular disease risk compared to high carbohydrate, low protein diet in obese adults: A randomized clinical trial. *Nutrition & Metabolism*. 2008; 5:30.

³ A 3-ounce serving of lean beef provides 25.4 grams of protein or 51 percent of the Daily Value.

⁴ The moderate-carbohydrate, moderate-protein diet was designed to fit within the Acceptable Macronutrient Distribution Range (AMDR) of the Dietary Reference Intakes as established by the Institute of Medicine. The AMDR for protein is 10 – 35% of calories.

Higher Protein Intake Associated with Heart Disease Prevention

Studies evaluating health risks across the range of protein intakes found individuals with the highest protein intake had the lowest risk for coronary heart disease (CHD) and the highest quality diets. Leading researchers conclude that earlier associations of dietary protein or protein foods with CHD may have been due to coincidental relationships with other modern lifestyle factors, such as total energy intake, daily physical activity, stress, inconsistent meal patterns and convenience foods.

Layman D, Clifton P, Gannon M, Krauss R, Nuttall F. Protein in optimal health: heart disease and type 2 diabetes. *American Journal of Clinical Nutrition*. 2008; 87 (suppl): 1571S-5S.

Lean Beef Does Not Increase Cardiovascular Risk

A review of 54 studies provides substantial evidence that lean red meat, trimmed of visible fat, does not raise total blood cholesterol or LDL (bad) cholesterol levels. When consumed as part of a diet low in saturated fat, lean, trimmed lean beef does not increase cardiovascular risk factors (plasma cholesterol levels or thrombotic risk factors).⁵

Li D, Siriamornpun S, Wahlqvist ML, Mann NJ, Sinclair AJ. Lean meat and heart health. *Asia Pacific Journal of Clinical Nutrition*. 2005; 14(2):113-119.

Bone Health

Elderly Should Increase Protein for Optimal Muscle and Bone Health

Osteoporosis and sarcopenia are degenerative conditions frequently associated with aging. Recent evidence suggests that increasing dietary protein above the DRI of 0.8 g/kg/d may help maintain bone and muscle mass in older individuals. Dietary protein also increases circulating insulin-like growth factor, which has anabolic effects on muscle and bone. In addition, protein increases calcium absorption, which could be anabolic for bone. Available evidence indicates that consuming up to 1.6 – 1.8 g/kg/d has a beneficial effect, although long-term studies are needed to show safety and efficacy. Given the available data, increasing the DRI to 1.0 to 1.2 g/kg/d would maintain normal calcium metabolism and nitrogen balance without affecting renal function.

Gaffney-Stomberg E, Insogna KL, Rodriguez NR, Kerstetter JE. Increasing dietary protein requirements in elderly people for optimal muscle and bone health. *Journal of the American Geriatrics Society*. 2009 Jun; 57(6):1073-9.

Protein and Calcium Positively Affect Bone Health

Protein and calcium intake interact positively to affect bone health, and intakes of both must be adequate enough to fully realize the benefit of each nutrient on bone. Optimal protein intake for bone health is likely higher than current recommended intakes, particularly for the elderly. Some studies found meat as a protein source is associated with higher blood levels of insulin-like growth factor 1 (IGF-1), which is associated with increased bone mineralization and fewer fractures.

Heaney R, Layman D. Amount and type of protein influences bone health. *American Journal of Clinical Nutrition*. 2008; 87 (suppl): 1567S-70S.

Protein Intake Has Positive Effects on Bone Health

A recent review article, which examined dietary protein and bone health, concluded that moderate-to-high protein intake has positive effects on bone health. In children and adolescents, protein intakes within the generally accepted normal range (0.8 – 1.5 g/kg/d and as high as 2.0 g/kg/d) have a significant impact on skeletal growth and peak bone mass. The positive effects of protein that adults experienced were increased bone mass and bone mineral density, reduced bone loss and improved recovery from hip fractures.

Conigrave AD, Brown EM, Rizzoli R. Dietary Protein and Bone Health: Role of Amino Acid – Sensing Receptors in the Control of Calcium Metabolism and Bone Homeostasis. *Annual Reviews*. 2008; 28:131-55.

⁵ Twenty-nine cuts of beef meet government guidelines for lean with less than 10 grams of total fat, 4.5 grams or less of saturated fat, and less than 95 milligrams of cholesterol per 3-ounce serving.

Relationship Between Diet and Cancer

No Causal Relationship between Red Meat and Cancer

Understanding the relationships between diet and cancer is particularly challenging, given the complexity of causes and risk factors associated with the disease. A systematic literature review evaluated 12 exposure variables against each of six cancer sites: colorectal, prostate, pancreatic, stomach, breast and kidney. This scientific review analyzed the 11 decades of evidence for and against causality based on the Bradford-Hill criteria. The review of the epidemiologic literature found no conclusive evidence of a causal relationship between red meat and any of the cancers.

Alexander et al. An Examination of Epidemiologic Studies of Red Meat Consumption and Cancer. Technical Report, prepared by Exponent Inc., Health Sciences; December, 2007.

No Association between Animal Fat or Animal Protein and Colorectal Cancer

A quantitative assessment of the available epidemiologic evidence demonstrated there is not consistent evidence of a positive association between consumption of animal fat or animal protein and colorectal cancer. The analysis examined six prospective cohort studies with comprehensive dietary assessments, contributing 1070 cases of colorectal cancer and ~1.5 million person-years of follow up. No statistically significant associations were observed in any of the animal fat and colorectal cancer meta-analyses.

Alexander DD, Cushing CA, Lowe KA, Scurman B, Robers MA. Meta-analysis of animal fat or animal protein intake and colorectal cancer. *American Journal of Clinical Nutrition*. 2009; 89:1-8.

Red Meat or Processed Meat Consumption Not Linked to Kidney Cancer

The findings of this meta-analysis are not supportive of an independent relation between red or processed meat intake and kidney cancer. The quantitative assessment analyzed data reports in 12 case-control studies, three cohort studies and a pooled analysis of data from 13 independent international cohorts and no consistent patterns or trends of increased risk with increasing levels of red or processed meat intake were reported.

Alexander DD, Cushing CA. Quantitative assessment of red meat or processed meat consumption and kidney cancer. *Cancer Detection and Prevention*. 2009; 32(5-6):340-51.

2005 Dietary Guidelines, Which Include Beef, Reduce Cancer Risk

The results of a clinical trial show adherence to the *2005 Dietary Guidelines* and to the USDA Food Guide, both of which include lean beef, reduced the risk of colorectal adenoma, a precursor of colorectal cancer, in a large sample of U.S. men and women. This study is further evidence that the most important dietary advice people can follow to decrease cancer risk are the *2005 Dietary Guidelines*, which recommend a nutrient-rich, balanced diet from all five food groups.

Dixon BL, Subar AF, Peters U, Weissfeld JL, Bresalier RS, Risch A, Schatzkin A, Hayes RB. Adherence to the USDA Food Guide, DASH Eating Plan, and Mediterranean Dietary Pattern Reduces Risk of Colorectal Adenoma. *Journal of Nutrition*. 2007; 137:2443–50.

Stearate, A Fatty Acid in Beef, Has Anti-Cancer Properties

Stearate (or stearic acid), a saturated fatty acid found in beef, has been shown to have “anti-cancer properties” targeting proliferating, migration and tumor invasion. This animal study showed that dietary stearate dramatically reduces the size of tumors and had an anti-metastasis effect. The study suggests that dietary manipulation with selected long-chain saturated fatty acids, such as stearate, may help breast cancer patients.

Evans LM, Toline EC, Desmond R, Siegal GP, Hashim AI, Hardy RW. Dietary stearate reduces human breast cancer metastasis burden in athymic nude mice. *Clinical & Experimental Metastasis*. 2009; 26:415-424.

CLA, Found Naturally in Beef, May Have Cancer-Fighting Properties

Beef is a natural source of conjugated linoleic acid (CLA), a polyunsaturated fatty acid. While research on CLA is still evolving, a body of evidence suggests this compound may have cancer-fighting properties, as well as positive effects on cardiovascular disease, body composition, insulin resistance, immune function and bone health.⁶

Bhattacharya A, Banu J, Rahman M, et al. Biological effects of conjugated linoleic acid in health and disease. *Journal of Nutritional Biochemistry*. 2006; 17:789-810.

⁶ Lean beef is one of the most common natural sources of CLA and is estimated to provide more than 30 percent of current CLA in the American diet.

CHOLINE

Choline Plays a Critical Role in Pregnancy

Choline deficiency in pregnant women can result in elevated levels of homocysteine, and could potentially result in birth defects. Choline works with folate to help promote brain and memory development in growing fetuses and newborn infants. A 3-ounce serving of lean beef is a good source of choline, providing approximately 18 percent of the highest Adequate Intake (AI) of 550 mg. Choline is currently consumed in amounts far below the AI, particularly among African Americans.

Jensen HH, Batres-Marquez SP, Carriquiry A, Schalinske K. Choline in the diets of the US population: NHANES, 2003-2004. *FASEB Journal*. 2007; 21:1b219.

Animal Foods Largest Source of Choline

Research shows that only 1 out of every 10 Americans get enough choline. Animal foods, including eggs, milk, chicken, beef, and pork are the largest dietary sources of choline. One 3-ounce serving of lean beef provides 18 percent of the highest Adequate Intake (AI) of 550 mg. One 3-ounce serving of extra lean ground beef provides 73 milligrams of choline, or about 13% of the highest AI.

Chiuve S, Giovannucci E, Hankinson S, et al. The association between betaine and choline intakes and the plasma concentrations of homocysteine in women. *American Journal of Clinical Nutrition*. 2007; 86:1073-1081.

B VITAMINS

Vitamin B₁₂ Important for Aging Population

This study shows that low vitamin B₁₂ status is an important risk factor for loss of brain volume in elderly community-dwelling adults. These findings suggest that plasma vitamin B₁₂ status may be an early marker of brain atrophy and thus a potentially important modifiable risk factor for cognitive decline in older adults. Additional studies are needed to help define whether optimization of vitamin B₁₂ status contributes to the maintenance of cognitive performance with successful aging.

Vogiatzoglou A, Refsum H, Johnston C, Smith SM, Bradley KM, de Jager C, Budge MM, Smith AD. Vitamin B₁₂ status and rate of brain volume loss in community-dwelling elderly. *Neurology*. 2008; 71:826-832.

Vitamin B₁₂ Protects Brain Power

In a study published in the *American Journal of Clinical Nutrition*, seniors with low vitamin B₁₂ status but high serum folate were more likely to experience anemia and cognitive impairment. When vitamin B₁₂ status was normal, however, high serum folate was associated with protection against cognitive impairment.⁷

Morris MS, Jacques PF, Rosenberg IH, Selhub J. Folate and vitamin B₁₂ status in relation to anemia, macrocytosis, and cognitive impairment in older Americans in the age of folic acid fortification. *American Journal of Clinical Nutrition*. 2007; 85(1):193-200.

ZINC

Dietary Zinc Required for Metabolic Function

Zinc is an essential nutrient, required for numerous metabolic functions, including translating gene information, growth and immunity. Manifestations of zinc deficiency include growth retardation, high rates of infection, skin lesions and impaired wound healing. Red meat, including beef, is a good source of bioavailable zinc as opposed to dietary zinc from plant sources which is less bioavailable.

Samman S. Zinc. *Nutrition & Dietetics*. 2007; 64(Supple. 4):S131-134.

⁷ A 3-ounce serving of lean beef provides 2.24 micrograms of vitamin B₁₂ or 37 percent of the Daily Value; 3.4 milligrams of niacin (vitamin B₃) or 17 percent of the Daily Value; and .297 micrograms of vitamin B₆ or 15 percent of the Daily Value.

IRON

Overweight Toddlers Are at Higher Risk for Iron Deficiency

A study published in *Pediatrics* found that overweight 1- to 3-year-olds, who are not in daycare, are at higher risk for iron deficiency. Researchers think this may be due to extended breastfeeding without introduction of iron-rich foods, or inadequate intake of iron-rich foods once the child is weaned. This is an important public health issue as 4 million U.S. children are iron-deficient, and childhood iron-deficiency anemia is associated with behavioral and cognitive delays.

Brotanek JM, Gosz J, Weitzman M, Flores G. Iron deficiency in early childhood in the United States: risk factors and racial/ethnic disparities. *Pediatrics*. 2007; 120(3):568-75.

Lean Meat Critical First Food for Breastfed Infants

A research review in the *Journal of Nutrition* found that iron- and zinc-rich meats are important first-foods for breastfed infants to provide essential micronutrients. In addition, the American Academy of Pediatrics, the World Health Organization and The Centers for Disease Control and Prevention all recommend meat as a complementary food to ensure that breastfed infants consume adequate amounts of these important nutrients.⁸ Krebs NF. Food Choices to Meet Nutritional Needs of Breast-fed Infants and Toddlers on Mixed Diets. *Journal of Nutrition*. 2007 February:511S – 517S.

Higher Cognitive Ability Related to Iron-Sufficient Infants

Researchers found that, even though children received iron therapy in infancy which corrected their iron deficiency anemia in all cases, iron-deficient children had lower motor scores than their iron-sufficient counterparts when tested in infancy, at age 5, and in early adolescence. The difference in motor scores remained constant throughout these life stages.

Shafir T, Angulo-Barroso R, Calatroni A, Jimenez E, Lozoff B. Effects of iron deficiency in infancy on patterns of motor development over time. *Human Movement Science*. 2006 December; 25(6):821-838.

Iron Boosts Mother and Baby Bonding

Iron deficiency may impair crucial mother-baby interactions. Researchers found mildly iron-deficient mothers were less sensitive to their babies' cues, were less likely to give their babies the chances to lead interactions, often interrupted play at inappropriate times, and appeared bored or distant more frequently than mothers with adequate iron levels.

Corapci F, Radan AE, Lozoff B. Iron Deficiency in Infancy and Mother-Child Interaction at 5 Years. *Journal of Behavioral and Developmental Pediatrics*. October 2006; 27(5):371-8.

NUTRIENT-RICH PACKAGE

Nutrient-Rich Diets May Contribute to Lower Risks of Mortality

Research reinforces the positive role nutrient-rich foods play in the diet. A study, which examined the health benefits of dietary patterns that follow current dietary guidelines and provide multiple nutrients, suggests women who follow diets including fruits, vegetables, whole grains, lowfat dairy and lean meats – or naturally nutrient-rich foods – have a lower risk of mortality.⁹

Kant, A, Schatzkin, A, Graubard, B, Schairer, C. A prospective study of diet quality and mortality in women. *Journal of the American Medical Association*. 2000; 283(16):2109-2115.

For more beef nutrition and science information visit www.BeefNutrition.org



The Beef Checkoff
through the National Cattlemen's Beef Association

⁸ A 3-ounce serving of lean beef provides 2.54 milligrams of iron or 14 percent of the Daily Value.

⁹ Calorie-for-calorie, beef is one of the most naturally nutrient-rich foods. A 3-ounce serving of lean beef is an excellent source of protein, zinc, vitamin B₁₂, selenium and phosphorus; and a good source of niacin, vitamin B₆, iron and riboflavin.