

# What Science Says About Beef's Naturally Nutrient-Rich Package

## **PROTEIN**

### **Muscle**

#### ***Protein, Muscle Maintenance and Sarcopenia Prevention***

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 of 0.8g/kg/ body weight 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.

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

#### ***Live Well and Age Vibrantly with Lean Beef***

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 each day 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.

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

#### ***Beef Up with Lean Protein***

A research review, "The Underappreciated Role of Muscle in Health and Disease," published in the *American Journal of Clinical Nutrition* 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 type2 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.

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

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

### **Weight Management**

#### ***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 thermogenesis, 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, Westterp-Plantega M. Protein, weight management, and satiety. *American Journal of Clinical Nutrition*. 2008. 87 (suppl): 1558S-61S.

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

### **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 Recommended Dietary Allowance can lead to increased hunger and a desire to eat among men.

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.

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

### **Rest Easy with Protein**

A Dutch study reports that consuming nearly a third of daily calories as lean protein, such as lean meat or skinless poultry, boosts a person's metabolism during the day – and while sleeping. The result is from protein's ability to increase satiety to a greater extent than carbohydrate and fat and can therefore reduce energy intake.

Lejeune MP, Westerterp KR, Adam TC, Luscombe-Marsh ND, Westerterp-Plantenga MS. Ghrelin and glucagon-like peptide 1 concentrations, 24-h satiety, and energy and substrate metabolism during a high-protein diet and measured in a respiration chamber. *American Journal of Clinical Nutrition*. 2006; 83(1): 89-94.

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

### **Moderately Higher-Protein Diet Boosts Benefit of Exercise**

Research shows exercise is more effective when coupled with a moderately high-protein diet. A study, from the *Journal of Nutrition* demonstrated that a protein-rich diet with reduced carbohydrates, combined with exercise additively improved body composition during weight loss, reduced triglyceride levels and maintained higher HDL (good) cholesterol levels. Researchers concluded that the protein-rich diet is successful in maintaining muscle mass while burning fat because high-quality protein foods, like beef, contain high levels of the amino acid leucine, which works with insulin to promote muscle growth.

Layman D, Evans E, Baum J, Seyler J, Erickson D, Boleau R. Dietary protein and exercise have additive effects on body composition during weight loss in adult women. *Journal of Nutrition*. 2005 August; 135: 1903-1910.

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

### **Higher-Protein Diet May Boost Metabolism and Other Benefits**

A clinical trial examined the effects of protein on body composition, cardiovascular disease risk, nutritional status, bone turnover, and kidney function in 100 obese women. Researchers found that people on the higher-protein diet (34% protein/46% carbohydrate/20% fat) lost more fat mass and achieved nutritional benefits either equal to or greater than those on the higher-carbohydrate diet (17% protein/64% carbohydrate/20% fat). In particular the higher-protein diet is associated with greater reduction in triglyceride concentration and improvements in hemoglobin and vitamin B<sub>12</sub> status. There was no evidence of adverse effects on bone health or kidney function.

Noakes M, Keogh JB, Foster PR, Clifton PM. Effect of an energy-restricted, high-protein, low-fat diet relative to a conventional high-carbohydrate, low-fat diet on weight loss, body composition, nutritional status, and markers of cardiovascular health in obese women. *American Journal of Clinical Nutrition*. 2005; 81(6): 1298-1306.

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

### **Higher Protein Intake is Associated with Less Belly Fat**

Abdominal obesity, or "belly fat," is significantly related to morbidity and mortality. It is unknown exactly why certain people tend to gain fat in the belly area, but a study may give insight as to how to avoid this. A cross-sectional study found that those who had the highest proportion of energy intake (or calories) from protein also had the lowest waist-hip ratio. Thus, replacing protein for carbohydrates may help to reduce stomach fat.

Merchant AT, Anand SS, Vuksan V, Jacobs R, Davis B, Teo K, Yusuf S. Protein intake is inversely associated with abdominal obesity in a multi-ethnic population. *Journal of Nutrition*. 2005; 135: 1196-1201.

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

### ***Study Shows that High-Protein, Low-Fat Diets Promote Healthful Weight Loss***

A study in the *Journal of Nutrition* tested a higher-protein, low-fat diet compared with a higher-carbohydrate, low-fat diet, and found equally favorable results. Both diets reduced cholesterol levels, body weight, and body fat mass equally. However, those on the higher-protein diet did not complain of hunger and were much more satisfied than those on the higher-carbohydrate diet.

Johnston, CS, Tionn SL, Swan PD. High-protein, low-fat diets are effective for weight loss and favorably alter biomarkers in healthy adults. *Journal of Nutrition*. 2004; 134: 586-591.

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

### ***Protein-Rich Diets Aid Weight Loss***

Research has shed light on why moderately high-protein diets may be beneficial for weight loss and muscle maintenance. The study theorizes that, due to the amino acid leucine found in protein-rich foods such as beef, increasing the proportion of protein to carbohydrates in the diets of adult women may have positive effects on body composition, blood lipids, glucose homeostasis and satiety during weight loss.

Layman DK, Boileau RA, Erickson DJ, Painter JE, Shiue H, Sather C, Christou DD. A reduced ratio of dietary carbohydrate to protein improves body composition and blood lipid profiles during weight loss in adult women. *Journal of Nutrition*. 2003 February; 133(2):411-7.

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

### **Bone Strength**

#### ***Bone Mineral Content with Protein***

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.

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

#### ***Calcium is Not Enough When it Comes to Bone Health***

A study confirms that middle-aged people who eat more protein-rich foods, such as beef, have fewer hip fractures resulting from osteoporosis. These findings support the hypothesis that adequate dietary protein is important for optimal bone health which can have a significant impact on overall health and independence.

Wengreen HJ, Munger RG, Cutler DR, Corcoran CD, Zhang J, Sassano NE. Dietary protein intake and risk of osteoporosis hip fracture in elderly residents of Utah. *Journal of Bone and Mineral Research*. 2004; 19(4):537-45.

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

### **Heart Health**

#### ***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.

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

## **Optimal Health**

### **Quality Protein Promotes Optimal Health**

A study assessed protein quality and dietary recommendations and found increasingly complex roles for protein and amino acids in, among other health benefits, 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 emerging evidence of a positive role for high-quality protein in promoting optimal health at intakes beyond the RDA of 0.8 g/kg/day.

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.

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

## **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 includes 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.

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.

\* *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 B<sub>12</sub>, selenium and phosphorus; and a good source of niacin, vitamin B<sub>6</sub>, iron and riboflavin.*

## **LEAN BEEF AND HEART HEALTH**

### **Healthy Beef = Healthy Heart**

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 beef does not increase cardiovascular risk factors (plasma cholesterol levels or thrombotic risk factors).

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.

\* *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.*

### **Lean Beef and Chicken Play an Equal Role in Cholesterol Reduction**

Research indicates that moderately overweight women who consumed lean beef or chicken as part of a nutritionally balanced, calorie-reduced diet, in conjunction with a fitness walking program, successfully lost weight, reduced body fat, lowered total cholesterol, lowered LDL (bad) cholesterol, and maintained HDL (good) cholesterol.

Melanson K, Gootman J, Myrdal A, Kline G, Rippe J. Weight loss and total lipid profile changes in overweight women consuming beef or chicken as the primary protein source. *Nutrition*. 2003; 19(5):409-414.

\* *All of the 29 lean beef cuts have, on average, only one more gram of saturated fat than a skinless chicken breast, per 3-ounce serving. In addition, each lean beef cut is a nutrient powerhouse with seven times more vitamin B<sub>12</sub>, six times more zinc and three times more iron than the same size serving of a skinless chicken breast.*

## **CONJUGATED LINOLEIC ACID**

### ***CLA and Cancer Protection***

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.

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.

\* *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.*

## **ZINC**

### ***Get Tweens to Think with Zinc***

Seventh graders who consumed an additional 20 milligrams of zinc, beyond their normal diet, each school day for 10 weeks scored better on visual memory and word recognition tasks, as well as functions requiring sustained attention and vigilance, than their counterparts who consumed less zinc.

Penland JG, Lukaski HC, Gray JS. Zinc affects cognition and psychosocial function of middle school children. Abstract presented at the American Society of Nutritional Sciences, Experimental Biology 2005 Conference. April 4, 2005; San Diego, CA.

\* *A 3-ounce serving of lean beef provides 5.76 milligrams of zinc or 38 percent of the Daily Value.*

### ***Build Better Brains with Beef***

Among healthy school-age children, increasing zinc intake has been demonstrated to improve cognitive performance. In fact, research from the *American Journal of Clinical Nutrition*, suggests zinc has a role in improving recall skills, reasoning, psychomotor function and attention.

Sandstead HH, Penland JG, Alcock NW, Dayal HH, Chen XC, Li JS, Zhao F, Yang JJ. Effects of repletion with zinc and other micronutrients on neuropsychological performance and growth of Chinese children. *American Journal of Clinical Nutrition*. 1998; 68(2 Suppl):470S-475S.

\* *A 3-ounce serving of lean beef provides 5.76 milligrams of zinc or 38 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.

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

### ***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.

Krebs NF. Food Choices to Meet Nutritional Needs of Breast-fed Infants and Toddlers on Mixed Diets. *Journal of Nutrition*. 2007 February:511S – 517S.

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

### **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.

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

### **Iron Boosts Mother/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.

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

### **Ironing Out Postpartum Depression**

Postpartum stress and depression, are estimated to affect 40 percent of U.S. pregnancies each year. Researchers found that anemic new mothers taking iron supplements experienced a 25 percent reduction in depression and stress.

Beard JL, Hendricks MK, Perez EM, Murray-Kolb LE, Berg A, Vernon-Feagans L, Irlam JI, Issacs W, Sive A, Tomlinson M. Maternal iron deficiency anemia affects postpartum emotions and cognition. *Journal of Nutrition*. 2005; 135:267-272.

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

### **Iron to Battle ADHD**

A report in the *Archives of Pediatric and Adolescent Medicine* found that 84 percent of children studied who had Attention Deficit Hyperactivity Disorder (ADHD) also had abnormal iron stores. In addition, researchers found the children with the lowest iron stores had the most severe ADHD symptoms. Researchers suggest these children could benefit from additional iron intake.

Konofal E, Lecendreux M, Arnulf I, Mouren MC. Iron deficiency in children with attention-deficit/hyperactivity disorder. *Archives of Pediatric and Adolescent Medicine*. 2004; 158(12):1113-5.

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

### **Lean Beef: Smart Food for Teens**

According to a study published in the *Journal of the American Dietetic Association*, diets rich in lean beef can help teenagers maintain their levels of useable iron, teach important balanced eating habits, and dispel misperceptions that healthy diets can't taste good.

Snetselaar L, Stumbo P, Chenard C, Ahrens L, Smith K, Zimmerman B. Adolescents eating diets rich in either lean beef or lean poultry and fish reduced fat and saturated fat intake and those eating beef maintained serum ferritin status. *Journal of the American Dietetic Association* 2004; 104(3):424-8.

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

## **B VITAMINS**

### ***Vitamin B<sub>12</sub> Protects Brain Power***

In a study published in the *American Journal of Clinical Nutrition*, seniors with low vitamin B<sub>12</sub> status but high serum folate were more likely to experience anemia and cognitive impairment. When vitamin B<sub>12</sub> status was normal, however, high serum folate was associated with protection against cognitive impairment.

Morris MS, Jacques PF, Rosenberg IH, Selhub J. Folate and vitamin B<sub>12</sub> 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.

### ***Bone Up with B<sub>12</sub>***

The Framingham Osteoporosis Study examined the relationship between vitamin B<sub>12</sub> blood levels and indicators of bone health in 2,576 men and women, aged 30-87. Researchers found that those with vitamin B<sub>12</sub> concentrations below 148 picomoles per liter (pM/L) had significantly lower average bone mineral density – at the hip in men and at the spine in women – than those with higher concentrations of the nutrient.

Tucker KL, Hannan MT, Qiao N, Jacques PF, Selhub J, Cupples LA, Kiel DP. Low plasma vitamin B<sub>12</sub> is associated with lower BMD: The Framingham Osteoporosis Study. *Journal of Bone and Mineral Research*. 2005; 20 (1) 152-158.

### ***Lacto-ovo Vegetarian Diet Impairs Vitamin B<sub>12</sub> Status***

Pregnant women who followed a vegetarian diet that included eggs and dairy products, but no meat, had an increased risk of vitamin B<sub>12</sub> deficiency, which is a risk factor for neural tube defects. In addition, breast-fed infants of a vitamin B<sub>12</sub> deficient mother are at greater risk for developmental abnormalities, impaired growth and anemia.

Koebnick C, Hoffman I, Dagnelie PC, Heins UA, Wickramasinghe SN, Patnayaka ID, Gruendek S, Lindemans J, Leitzmann C. Long-term ovo-lacto vegetarian diet impairs vitamin B<sub>12</sub> status in pregnant women. *Journal of Nutrition*. 2004; 134(12):3319-3326.

### ***Additional B Vitamin Added to the Alzheimer's Prevention Arsenal***

While vitamins B<sub>12</sub>, B<sub>6</sub> and folate have been shown to have positive effects on dementia, research found that people consuming more than 22.4 milligrams of niacin, or vitamin B<sub>3</sub>, from food daily were 80 percent less likely to suffer Alzheimer's disease and age-related cognitive decline than their counterparts.

Morris MC, Evans DA, Bienias JL, Scherr PA, Tangney CC, Hebert LE, Bennett DA, Wilson RS, Aggarwal N. Dietary niacin and the risk of incident Alzheimer's disease and of cognitive decline. *Journal of Neurology Neurosurgery and Psychiatry* 2004; 75:1093-1099.

\* A 3-ounce serving of lean beef provides 2.24 micrograms of vitamin B<sub>12</sub> or 37 percent of the Daily Value; 3.4 milligrams of niacin (vitamin B<sub>3</sub>) or 17 percent of the Daily Value; and .297 micrograms of vitamin B<sub>6</sub> or 15 percent of the Daily Value.

**For more beef nutrition and science information visit [www.BeefNutrition.org](http://www.BeefNutrition.org)**



The Beef Checkoff  
through the National Cattlemen's Beef Association