High-Protein Diets

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Contributing Editor

From the Atkins diet to some forms of the Paleo diet, high-protein diets are common for weight loss. Such diets restrict carbohydrate intake so the body goes into ketosis, a metabolic state where it burns its own fat for fuel. How effective are these and what are the parameters?

Creating ketosis

Ketosis is achieved by limiting carbohydrate intake, resulting in decreased glucose availability, favoring fatty-acid oxidation. Fat is converted into fatty acids and ketone bodies, leading to increased blood ketones that serve as a fuel source for cells that cannot use fatty acids for energy. As an alternate fuel source, ketones attenuate muscle-tissue breakdown for energy production *(Cleveland Clinical Journal of Medicine*, 2002; 69:849-962; Nutrition and Traumatic Brain Injury, National Academies Press, 2011).

A ketogenic diet is one that is low in carbohydrate, though there is no universal standard for the carbohydrate, protein or fat content. However, studies have outlined varying amounts of carbohydrate to induce ketosis. One residential study in obese men used an *ad libitum* diet containing 4% carbohydrate, 66% protein and 30% fat, which induced ketosis after one to three days (*American Journal of Clinical Nutrition*, 2008; 87:44-55). Other researchers defined a low-carbohydrate ketogenic diet as one containing a maximum of 50 grams of carbohydrate per day regardless of fat and protein content *(Current Atherosclerosis Reports*, 2003; S:476-483). And, the traditional ketogenic diet, used as a treatment for pediatric epilepsy, is described as one that contains a fat-to-protein ratio of 4:1. Overall, studies and clinical experience suggest there is a maximum dietary carbohydrate threshold of 65 to 180 grams per day to initiate lipolysis and ketosis (*American Journal of Physiology*, 1992; 262:E631-E636).

Low-carbohydrate ketogenic diets are a viable dietary approach to obesity because ketosis can decrease hunger levels and subsequent calorie

intake (*American Journal of Clinical Nutrition*, 2008; 87:44-55). In addition, a traditional ketogenic diet, marked by its high fat content and reduced carbohydrate and protein content, reduces serum insulin levels, leading to a low insulin/glucagon ratio and lipolysis. Finally, studies show low-carbohydrate ketogenic diets decrease fasting blood glucose levels, blood triglycerides and high-density lipoprotein (HDL) cholesterol in obese adults (*Current Atherosclerosis Reports*, 2003; S:476-483; *American Journal of Clinical Nutrition*, 2008; 87:44-55).

Nutrition pitfalls

Because ketogenic diets are low in carbohydrate, they may fall short on fiber, vitamins A, C and E, thiamin, folic acid, iron, calcium and magnesium (*Cleveland Clinic Journal of Medicine*, 2002; 69:849-862; *American Journal of Clinical Nutrition*, 2010; 92:304-312; *The American Journal of Cardiology*, 2001; 88:59-61). However, to date, most studies on low-carbohydrate diets, including low-carbohydrate ketogenic diets, have included a multivitamin. In addition, some have also included sodium and potassium supplements (*American Journal of Clinical Nutrition*, 2007;86:276-284).

And though research suggests that ketogenic diets are safe in the short term, they should be followed only under medical supervision (*The New England Journal of Medicine*, 2008; 359:221-241).

Other potential drawbacks of ketosis include weakness, fatigue, nausea, dehydration and light-headedness. And, while some have suggested that the low-carbohydrate intake characteristic of a ketogenic diet makes sustaining a high-intensity exercise program difficult, research has found that people adapt to this diet and, after the adaptation period, they are able to sustain submaximal endurance performance by shifting their major source of fuel from carbohydrate to fat (*Nutrition & Metabolism*, 2004; 1:2). In fact, one study found that subjects could withstand prolonged exercise after maintaining a low-carbohydrate diet (less than 10 grams per day) for a 6-week period (*Journal of Clinical Laboratory & Investigation*, 1967; 19:218-229).

Designing for the dieters

High-quality protein, rich in essential amino acids, is a key component of ketogenic diets. A minimum of 1.2 to 1.7 grams of protein per kilogram body weight is necessary to preserve muscle mass when on a low-carbohydrate ketogenic diet (*American Journal of Clinical Nutrition*, 2007; 86:276-284). In addition to consuming an adequate amount of protein daily, individuals on a ketogenic diet should aim for a minimum of 30 grams of high-quality protein per main meal to maximally stimulate muscle-protein synthesis (*Journal of the American Dietetic Association*, 2009; 109:1,582-1,586). High-quality proteins are rich in the eight essential amino acids responsible for stimulating muscle-protein synthesis. The amino acid leucine may be of particular importance. According to research, a 2.5 gram dose of leucine post-meal triggers an anabolic response that is protective of metabolic tissue during weight loss while also increasing fat loss (*Current Opinion in Clinical Nutrition and Metabolic Care*, 2010; 13:403-407). The dairy proteins whey and casein, egg whites, soy protein isolate, Parmesan cheese, Romano cheese, and milk are some of the best sources of leucine (USDA Nutrient Data Laboratory, 2011). In addition, with a little flavor masking, branched-chain amino acids or leucine can be formulated into various foods and beverages, and work especially well with citrus flavors.

Low-carbohydrate ketogenic diets are an obesity treatment option. These diets can facilitate weight loss while also improving fasting blood glucose, high-serum triglycerides, HDL and total cholesterol levels. Manufacturers designing products for ketogenic diets may want to consider adding micronutrients and electrolytes, in addition to paying close attention to the product's macronutrient makeup.

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