

Higher Protein Diets and Weight Management

A growing body of research indicates that higher protein diets can help achieve and maintain a healthy body weight. Whey protein, a high quality milk protein, can help build a higher protein diet and can fit into weight management plans. This report summarizes the available science including evidence that higher protein diets may help preserve lean body mass and stimulate fat loss during weight loss -- potentially through satiety, thermogenesis, and other mechanisms.

Scientific Status Report

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Introduction

A growing body of research reveals that higher protein diets can have beneficial health effects including helping to achieve and maintain a healthy body weight.^{1,2,3,4} Further, protein sources may differ in their ability to regulate body weight.^{2,4} Milk proteins may play an important role in weight management.⁵ Dairy foods are a source of high-quality or “complete” proteins, casein and whey, which provide all the amino acids that humans cannot synthesize.^{6,7} Whey protein in particular is a rich source of leucine, a branched chain amino acid demonstrated to have beneficial effects on body weight and composition.^{8,9,10}

The current Recommended Dietary Allowance (RDA) for protein is 0.8 g/kg body weight/day for both men and women 19 years and older.⁷ The RDA is based on consumption of high quality protein and is the amount of protein to prevent a deficiency, not necessarily an optimal amount to promote health. For a 150 lb adult, the RDA for protein is 55 g/day. The Institute of Medicine introduced an Acceptable Macronutrient Distribution Range (AMDR) for protein of 10-35% of total calories for adults (i.e., 50-175 g protein per day for adults consuming a 2,000 kcal/day diet).⁷ The AMDR for protein allows flexibility to meet individual needs.⁷ Protein typically provides about 15% of adults’ total energy intake in the U.S.¹¹

Weight Management

Research shows that protein intake at levels above the RDA, but not exceeding the upper limit of the AMDR, may aid in body weight regulation through its ability to increase satiety, increase thermogenesis, and improve body composition (i.e., increase fat loss and retain lean muscle mass).^{2,3,4} Furthermore, increasing dietary protein has been shown to be effective in preventing weight regain following weight loss in obese subjects.^{12,13} According to a large, randomized study in 548 overweight or obese adults who completed a weight loss program, a diet consisting of higher protein content (25% of energy) and low-glycemic foods consumed *ad libitum* for 26 weeks resulted in less weight regained than consuming a lower-protein (13%) diet with high glycemic index foods.¹² Likewise, better weight maintenance and fat reduction were found in moderately obese subjects who consumed a low-fat, high protein diet containing either casein or whey (50 grams extra per day) for 12 weeks following a weight loss program compared to a low-fat, high carbohydrate diet.¹³ No differences were observed between the casein or whey supplemented high protein groups.

Dietary Protein and Satiety

It is generally accepted that calorie-for-calorie, protein intake increases satiety - a feeling of fullness after or between meals - to a greater extent than either carbohydrate or fat under most conditions.⁷ Studies show that higher protein diets increase satiety compared to lower protein diets.^{2,4,14,15,16,17,18} Evidence that a higher protein intake (30% of energy) improves perceptions of meal-related satiety during energy restriction (- 750 kcal/day) compared to a lower protein intake (18% of energy) was demonstrated in a randomized, controlled trial that assessed meal-related satiety in 46 overweight and obese women.¹⁵ Similar findings have been reported in overweight or obese men.^{16,17} In a recent 12-week longitudinal study of 27 overweight or obese men consuming either a higher protein (25% of energy) or typical protein (14% of energy) energy-restricted diet, the higher protein intake during weight loss improved daily satiety and evening appetite control.¹⁷ The findings led the researchers to conclude that moderately increasing the protein content of an energy-restricted diet consumed in three meals/day results in better appetite control and satiety in overweight and obese men.¹⁷

Potential mechanisms underlying protein-induced satiety include increases in the concentration of appetite-suppressing hormones such as insulin, glucagon-like peptide-1, cholecystikinin, and peptide YY and/or decreases in appetite-stimulating hormones such as ghrelin.^{19,20} However, the effect of

increased protein intake on changes in hormone levels is inconsistent and likely related to the amount and type of protein consumed. Emerging evidence suggests that the branched chain amino acid leucine may enhance satiety.^{5,10,20}

There is some suggestion that different dietary proteins vary in their effect on satiety.^{19,21} Some studies, mostly short-term, have shown that higher intakes of dairy proteins, casein (~80% of milk protein) and whey (~20% of milk protein), increase satiety, although their effect on later food intake varies due to such factors as the quantity and time of measurement of satiety (i.e., short-term vs. long-term).^{4,5,19,22} Some studies indicate that whey protein has a more favorable effect on appetite control than other proteins such as casein, egg, and soy,^{23,24} whereas no differences in appetite and/or food intake have been found in other studies comparing whey with casein, gluten, or soy.^{25,26} Researchers suggest that it may not be possible to distinguish the satiating effects of different proteins when the concentration of amino acids is above a threshold level.²⁷ Differences in satiety between whey and casein observed in some studies may be explained in part by the timing of the study. Whey protein is described as a relatively “fast” protein (i.e., digested and absorbed faster, causing a quick increase in circulating amino acids), whereas casein is a relatively “slow” protein (i.e., digested and absorbed more slowly, providing a more consistent release of amino acids), which may have a later satiating effect.²²

A short-term randomized study comparing whey’s effects on appetite and energy intake with those of other proteins from whole foods (i.e., tuna, turkey, egg albumin) in lean healthy men found that the whey protein meal produced a greater insulin response, reduced appetite, and decreased *ad libitum* energy intake at a subsequent meal compared with the other protein meals.²¹ The researchers suggest that these favorable effects of whey protein may be due to its high content of leucine, which has been shown to lower food intake, and alterations in satiety hormones.²¹ In another randomized study in 17 men which compared the effect on satiety of three isocaloric test meals containing either a whey drink, a casein drink, or milk, milk intake reduced energy intake at a subsequent *ad libitum* lunch (4 hours later) more than the isocaloric drinks containing only whey or casein.²⁸

Dietary Protein and Thermogenesis

It is recognized that dietary protein increases thermogenesis - the increase in energy required for digesting, absorbing, and metabolizing ingested nutrients - to a greater extent than either carbohydrate or fat.^{2,4} Diet-induced energy expenditure is reported to increase by 20% to 30% for protein, 5% to 10% for carbohydrate, and 0% to 3% for fat.²⁹ Studies demonstrate that higher protein meals lead to a greater postprandial energy expenditure compared with normal protein meals.^{30,31} When researchers examined the effects of consuming diets with either 25% or 10% of energy from casein (i.e., the single protein source) for three days in 24 healthy adults, 24-hour total energy expenditure increased by 2.6% in those consuming the higher protein diet.³¹

The thermogenic effect of dietary protein may differ according to the type of protein. A clinical trial in 23 healthy adults examined the thermic effect of four isocaloric meals - three test meals which provided 50% of energy as whey, casein, or soy protein and a meal consisting almost entirely of carbohydrate.³² The test meals provided 20% of each subject’s energy requirements. The thermic effect of the whey meal was greater than that of either the casein or soy meals, and the thermic effect of all three protein meals was significantly greater than that of the high carbohydrate meal.³² The results of this study support the greater thermic effect of protein-rich meals compared to high carbohydrate meals of equal energy and provide evidence of different proteins’ thermic effect.

Dietary Protein and Body Composition

Reducing calories alone can lead to weight loss, but the weight loss often includes both body fat and lean muscle.¹⁰ Maintaining muscle mass is important for preventing weight regain following weight loss and for long-term metabolic health. Accumulating research indicates that higher protein diets may favorably affect body composition by increasing fat loss and/or preserving or increasing lean muscle mass during weight loss, as well as preserving muscle during weight maintenance.^{4,10,33}

When 130 obese adults were fed an energy-restricted diet containing either higher protein (30% of energy) or typical protein (15% of energy) in a 12-month trial (4 months of weight loss followed by 8 months of weight maintenance), the higher protein diet led to greater fat losses and improvements in body composition during initial weight loss and long-term maintenance, although total weight loss did not differ between the two diets.³³

A recent study in 90 overweight or obese premenopausal women showed that diet and exercise-induced weight loss with higher protein and increased dairy intake (low-fat milk, yogurt, full-fat cheese) improved the quality of weight loss by promoting a more favorable body composition.³⁴ The women, who participated in a combined aerobic and resistance training program and consumed a diet modestly restricted in energy, were randomized into one of three groups: high protein/high dairy (30%/15% of energy), adequate protein/adequate dairy (15%/7.5% of energy), or adequate protein/low dairy (15%/<2%). Over the 16-week study, losses of body weight and total body fat were similar. However, the high protein/high dairy group, which obtained half of their protein intake through dairy foods, lost more abdominal fat compared with the adequate protein/low dairy group.³⁴ Loss of abdominal (centrally located) fat is of importance considering that abdominal fat is a risk factor for type 2 diabetes, heart disease, and stroke.³⁵ The high protein/high dairy group also experienced an increase in lean body mass, whereas lean body mass decreased in the adequate protein/low dairy group.³⁴ In overweight or obese postmenopausal women participating in a weight loss regimen (a reduced-calorie diet and exercise), more weight was lost and more leg muscle mass was maintained relative to the weight lost in those receiving a protein supplement (i.e., 25 g of whey protein twice a day) compared to the women receiving a carbohydrate-based supplement of equal calories for six months.³⁶ Further evidence of protein's favorable effect on body composition comes from a randomized controlled trial in 25 healthy adults which demonstrated that while more protein resulted in greater weight gain during overeating, it increased lean body mass and metabolic rate, but did not contribute to an increase in body fat.³⁷

In addition to the quantity of protein, the quality of protein may influence body composition.¹⁰ Intake of animal protein, especially dairy protein, has been associated with a more favorable effect on body composition than plant protein.^{38,39} Findings of a study in 73 overweight and obese adults assigned to consume a 200 calorie beverage consisting of 28 g of whey or soy protein plus carbohydrate or carbohydrate alone twice a day for 23 weeks showed that the whey protein groups lost more weight and total fat than the carbohydrate group.⁴⁰ Additionally, waist circumference was lower in the whey group than the carbohydrate or soy protein groups. Those who consumed soy protein did not exhibit significant differences from the carbohydrate group or differences from the whey group for fat and weight loss.⁴⁰ According to a randomized, double-blind trial in 48 adults receiving a formula food containing predominantly soy protein or milk protein for 20 weeks, the milk protein formula led to greater reductions in visceral and subcutaneous fat compared to the soy protein formula.⁴¹

The distribution as well as the amount of high quality protein intake during the day may also be an important determinant of body composition.^{10,42} A recent study in 27 healthy young adults showed that consuming higher amounts of high quality protein, including dairy protein, at meals throughout the day was associated with less abdominal fat than when protein was consumed less often.⁴² This finding

supports previous evidence indicating that maintaining protein quantity and quality at individual meals throughout the day may help preserve lean body tissue during weight loss.¹⁰

One factor that may benefit increasing animal protein such as whey protein in improving body composition during weight reduction is leucine.¹⁰ Leucine stimulates muscle protein synthesis, thereby helping to spare lean body mass during weight reduction.¹⁰ To optimize muscle protein synthesis, researchers estimate that nearly 9 g/day of leucine may be needed, an amount nearly double the leucine content of Americans' dietary protein intake.¹⁰ Based on the science, some researchers estimate that humans may benefit from at least 25-30 g of protein containing a minimum of 2.5 g leucine per meal to stimulate muscle protein synthesis.^{10,43} A protein's leucine content therefore may be a critical factor in determining its quality. The leucine content of milk proteins is approximately 10% by weight, whereas that of wheat protein is only 6.8%.¹⁰ Therefore, a higher intake of plant protein than milk protein at each meal would be necessary to provide the amount of leucine proposed to optimize muscle protein synthesis. Current dietary guidelines for protein, which are based on percentage of energy in relation to carbohydrates and fats, do not focus on the potential beneficial attributes some amino acids, such as leucine, contribute to health.¹⁰ Experts suggest that as part of a higher protein diet, it is more beneficial to consume high quality protein at each meal – breakfast, lunch, and dinner – than just later in the day as is customarily consumed in the U.S.¹⁰

Conclusion

Accumulating research indicates that consuming a higher protein diet during energy restriction - particularly by consuming 25 to 30 g of high quality protein containing a minimum of 2.5 g leucine at each meal throughout the day - is an important strategy for successful long-term weight loss.¹⁰ Dairy proteins are high-quality proteins containing branched-chain amino acids such as leucine. Whey protein in particular is a rich source of leucine. Diets higher in protein, including dairy protein (casein, whey), may help in weight management and in preserving lean body mass and/or reducing fat mass. These benefits may be mediated by increasing satiety, thermogenic or other effects. Consuming a nutritionally balanced diet including high quality protein, such as three cups of fat-free or low-fat milk and milk products (e.g., cheese, yogurt), as recommended by the 2010 Dietary Guidelines,⁴⁴ throughout the day, as well as foods and beverages incorporating whey protein, can help build a higher protein diet to support weight loss and maintenance.

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