High-protein intake and kidney disease in body builders: a literature review

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Abstract
There is debate that a chronically high-protein intake is unhealthy and may result in a metabolic strain on the kidneys leading to impaired renal function and disease. This is a pressing health concern for body builders, who are strength-training athletes that follow a regime high-protein diet accompanied by high intensity training. The Recommendation Dietary Allowance (RDA) for protein consumption is 0.8-kg/g/per-body weight, while a body builder consumes significantly more than this amount. The aim of this review is to examine the association in body builders between a high-protein intake and the risk of kidney disease through analyzing the RDA protein recommendations, high-protein intake, and trials in healthy, exercised trained participants versus participants with pre-disposed kidney disorders. A total of 13 research articles were analyzed. Overall, a high-protein intake did not show to increase the risk of kidney disease in healthy, exercised trained individuals. The research studies suggesting a link between a high-protein diet and kidney disease was attributed to a study population of rats and individuals with pre-existing kidney diseases. To better understand the role of protein intake in the development of kidney disease, high-quality observational studies are needed with a longer trial period in a specific population of body builders.

Keywords
Protein; kidney disease; body builders; literature review
Introduction

There is widespread debate that a chronically high-protein intake is unhealthy and may result in a metabolic strain on the kidneys leading to impaired renal function and the sequential development of kidney disease. This is a pressing health concern for the population of body builders, who are strength-training athletes that follow a habitual high-protein diet and execute high-intensity training. Adequate protein consumption is required to support the maintenance of lean body mass (LBM) and a body builder typically requires a higher intake of protein to support increased physical activity, muscle recovery time and growth of LBM (Helms, et al., 2014; Riddington, 2014). On one hand, the American Heart Association’s (AHA) Nutrition Committee state, “Individuals who follow these [high protein] diets are at risk for… potential cardiac, renal, bone, and liver abnormalities” (Riddington, 2014). On the other hand, research studies have not found a correlation between a high-protein diet and kidney disease in a healthy, exercised-trained individual (Trumbo et al., 2002; Campbell et al., 2007; Riddington, 2014).

The aim of this article is to illustrate the effects of a high-protein diet to the relationship of kidney disease in body builders. The scope of this article is limited to the strength-training athlete population, focused on body builders, due to the increased consumption of protein in their diet. This literature review will provide insight into the health effects of a high protein diet in body builders, while providing research to emphasize that there is no significant increased risk of developing kidney disease from the consumption of a high-protein diet in body builders.

Results

The search identified 13 manuscripts that reported findings between a high-protein diet and the risk of developing kidney disease using data different research studies. The literature review is grouped into the subtopics of protein recommendations, high protein intake, and trials
in healthy, exercised trained participants versus participants with pre-disposed kidney disorders, in order to clearly discuss the literature on the correlation between a high-protein diet and kidney disease.

**Protein Recommendations**

There is debate on the safety and effectiveness of protein consumption over the current recommended daily allowances (RDA). At the moment, the RDA for protein is 0.8-g/kg bodyweight for sedentary, healthy adults (Trumbo *et al.*, 2002). However, research suggests those who engage in physical activity require more dietary protein than sedentary individuals, ranging anywhere from 1.6 to 2.0 g/kg/day (Campbell *et al.*, 2007). Furthermore, body builders go beyond the standard physical activity by performing resistance training, cardiovascular training, calorie restriction, and aim to achieve very lean conditions (Campbell *et al.*, 2007). All together, these factors collaborate to increase the protein requirements for body builders, which are significantly higher than the existing RDA for protein.

The recent research shows that the RDA doesn’t match the protein requirements for body builders. There are three notable recommendations for increased protein consumption in body builders. First, Dr. Michael Colgan, from Optimum Sports Nutrition, claims that the RDA doesn’t meet the needs of athletes who train in an intense fashion (Helms, *et al.*, 2014). Secondly, Dr Peter Leon states that, “the RDA for those engaged in strength training should be 1.7 – 1.8 grams of protein per kilogram of body mass per day” (Riddington, 2014). Thirdly, Susan Kliener states in her book, “Power Eating,” that for muscle building an intake of 1.6 – 2.2 grams per kilogram of bodyweight is recommended (Riddington, 2014).
High-Protein Intake

When analyzing the relationship between a high-protein intake and kidney function, there is a belief that habitual protein consumption in excess of the RDA promotes chronic renal disease. In a high protein diet, the beneficial effects on energy homeostasis through inducing satiety and increasing energy expenditure, while the detrimental effects on glucose homeostasis through promoting insulin resistance and increasing gluconeogenesis (Gropper, 2008).

When concentrating on healthy individuals, there is research in favor of a high protein diet without kidney complications. A scientific review on protein intake and renal function stated that, “there is no reason to restrict protein in healthy individuals” (Riddington, 2014). The review concluded that not only does a low protein intake not prevent the decline in renal function with age; it may actually be the major cause of the decline.

Trial in Healthy, Exercised Trained Individuals

In trials in healthy, exercised trained individuals, the International Society of Sport Nutrition position stand on protein and exercise, the research found that when part of a balanced, nutrient-dense diet, protein intakes at 1.4-2.0 g/kg/day are not detrimental to kidney function in healthy, active persons (Campbell et al., 2007). They state, “concerns that protein intake within this range is unhealthy are unfounded in healthy, exercising individuals” (Campbell et al., 2007). Elaborating the point by claiming that this intake is not only safe, but also it may improve the training adaptations to exercise training (Campbell et al., 2007). Furthermore they state, “it is often erroneously reported by popular media that a chronically high protein intake is unhealthy and may result in unnecessary metabolic strain on the kidneys leading to impair renal function” (Campbell et al., 2007). However, there is no substantial evidence that protein intakes in these
ranges suggested above will have adverse effects in healthy, exercising individuals (Campbell et al., 2007).

In addition, a study by Poortmas and Dellaalieux investigated body-builders and other well-trained athletes with high and medium protein intake. The study found that a protein intake under 2.8 g/kg does not impair renal function in well-trained athletes (Poortmans and Dellaalieux, 2000). Then, in a study by Fern and Tarnopolosky, they used amounts of protein ranging from 1.3 – 3.3 g/kg/day in strength athletes. They found that 2.4 g/kg/per day was considered protein overload, which provided no further increase in protein synthesis for strength and power athletes (Fern, et al., 1991). This study found that after a certain point, no additional positive benefits are seen from protein overdoes, yet it does not look into the negative effects.

**Trial in Participants with Pre-disposed Kidney Disorders**

Kidneys are responsible for excretion of urea formed from ammonia, which is a toxic by-product from protein digestion and metabolism. (Gropper, 2008). The kidneys are involved in nitrogen excretion and it has been theorized by some that a high nitrogen protein intake may cause stress to the kidneys. Several studies have found a correlation between a high protein intake and kidney disease in a population with predisposed kidney problems or animals. In the related literature, the main points of debate is that habitual protein consumption in excess of the RDA promotes chronic renal disease through increased glomerular pressure and hyperfiltration (Withers, et al., 1997; van der Ploeg, et al., 2001).

In a review by Walser, he proposed that protein intake plays a role in the development of renal disease through the promotion of nephrolithiasis, enhancement of the morbidity of acute renal failure, and acceleration of glomerulosclerosis (Walser, 1999). The only study to have shown harmful high protein intakes on kidney function was performed in a study by Brenner, in
the New England Journal of Medicine, on dietary protein intake and the progressive nature of kidney disease (Brenner, 1982). This study found that sustained protein in the diet increases renal blood flow and glomerular filtration rates, which may accelerate the development of glomerular sclerosis, leading to rapid loss of renal function. Yet, the population of the study focused on glomerular hyperfuntion in a “rat made diabetic with streptozocin” and children and young adults with juvenile diabetes (Brenner, 1982).

**Discussion**

In protein recommendations, the research states that 1) the RDA for protein is 0.8-g/kg bodyweight for sedentary, healthy adults (Trumbo et al., 2002), 2) those that engage in physical activity require 1.6 to 2.0 g/kg/day (Campbell et al., 2007), and 3) body builders require from 1.7 to 2.2 g/kg/day (Riddington, 2014). The increased protein intake is attributed to the requirement to build muscle in correspondence to the increased caloric expenditure of strength training athletes. The difference between the literatures in suggested protein intakes may be attributed to the authors’ different opinions for protein-intake in muscle building or individuals’ differences in caloric intake and expenditure. The strength of these studies is highlighted by the direct literature focused on body builders and protein intake to build muscle, while the opinions may be limited by generalizing the athletes into one group rather than accounting for individual’s differences in their metabolism.

In protein intake, the studies conducted on body builders consuming moderate protein intake revealed no significant differences in kidney function between the groups, while emphasizing that a high-protein diet was actually beneficial to these healthy individuals. Overall, the research claimed that 1.4-2.0 g/kg/day are not detrimental to kidney function in healthy, active persons (Campbell et al., 2007) and that a protein intake under 2.8 g/kg does not impair
renal function in well-trained athletes (Poortmans and Dellalieux, 2007). These studies concluded that high-protein diets are not hazardous for the kidneys in healthy individuals. Interestingly, the strength of these studies are highlighted by their specific population of body builders, through directly investigating healthy, well-trained athletes. However, the studies are also limited by their degree of external validity. The specific population of body builders limits the external validity because the results may not be generalizable to the population at large. For instance, these studies do not account for body builders with pre-existing health conditions, less-trained athletes that may be more susceptible to kidney disease as a result of following a high-protein diet, or an average adult that does not exercise. While, in the study by Fern and Tarnopolosky that investigated protein overdoes, they found that after a certain point, no additional positive benefits are seen from a high-protein intake, yet it does not look into the negative effects (Fern, et al., 1991).

In the trials on participants with pre-disposed kidney disorders, several possible reasons account for the negative association between a high-protein diet and kidney disease in the studies and published articles. The inverse association between a high-protein diet and kidney disease may be confounded by a variety of factors. In the studies, the claims were attributed to a study population with pre-existing kidney conditions and testing on animals. Testing on animals, especially rats, is problematic because the development of chronic renal failure with age is unavoidable because the predominant lesion in rats is glomerulosclerosis. First, in Brenner’s study, the research applies to the negative association of protein intake in a population with pre-existing kidney diseases. This study cannot be generalized to athletes with normal kidney function, assuming they will experience kidney disease due to high intakes of dietary protein. Next, in Walser’s study, this recommendation cannot be supported for the following reasons:
calorie restriction is more effective in rats than is protein restriction in declining renal function, protein restriction tends to lower glomerular filtration rate rather than increases it, and there is no evidence suggesting that a high intake of protein causes progressive reduction in renal function (Manninen, 2005). In the investigation by Poortmans and Dellalieux (2000), they found a high-protein intake does not impair renal function in the short term. In order to understand the long-term effects of protein consumption on bodybuilders, it is imperative to increase the length of the study. Therefore, this study could be limited in the shortened time length (Poortmans and Dellalieux, 2000).

In future studies, it is imperative that a high-protein diet is tested on bodybuilders over a continuous, long-time period. There doesn’t seem to be any peer-reviewed studies done on relatively healthy, strength training, weightlifters, or bodybuilders conducted over a long time frame to show the long-term effects of a high protein diet. In addition, the effects of supplemental protein in bodybuilders should be investigated.

Conclusion

The role of protein is very important to overall body function, and even more important to bodybuilders. The positive effects of protein can be beneficial for the hypertrophy of the muscle complex, however a common argument raised is that excessive protein can cause a variety of health problems, such as kidney disease. The literature presented contradicts the statements that high protein diets are unsafe and supports high protein diets in the prevention and treatment of kidney disease in healthy, exercised-trained individuals.

Protein intake ranging from 1.4 - 3.3 grams of protein per kilogram of bodyweight can be beneficial for an individual involved in an intense training program (Riddington, 2014). While
for body builders, taking more than the RDA when exercising is not only safe, but it is beneficial for increased lean body mass.

Kidney damage, liver damage, heart disease, osteoporosis and other health disease have been blamed to some degree on high protein intakes. Since the kidney is responsible for filtering urea, a byproduct of protein metabolism, a high-protein intake may be believed to lead to an excess production of ketones and urea. However, there is very little scientific validity to this claim and much scientific evidence to the contrary, as shown through this paper. While high protein intakes have not been shown to negatively affect a healthy person’s kidney, individuals with a history of kidney problems should be aware of their susceptibility to adverse reactions from excess dietary protein (NRC, 1989).

Overall, the evidence presented shows that a high-protein diet in body builders does not result in an increased risk of developing kidney disease or comprised renal function. The literature supports that a high protein diet results in positive effects for body builder through producing muscle growth, hypertrophy, increased muscle recover, and increased lean body mass.
References


