Can High Protein Diets Cause Kidney Damage?

Design of A Study to Determine the Relationship between a High Protein Diet and Kidney Disease

**Tag Words:** Protein, Supplements, Workout, Nutrition, Weight loss, Kidney disease

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**Summary**

There is a general understanding among certain populations that high protein diets are beneficial. Bodybuilders may utilize a high protein diet to increase lean muscle mass, while someone trying to lose weight may eat more protein to feel fuller, thus eating less. Despite the hype, most people fail to realize that Americans generally get twice as much protein as recommended. Little information is available about the long term side effects of a high protein diet, so we have designed a research experiment to investigate the potential long term effects of a high protein diet on kidney function.

**Video Link:** [http://youtu.be/CRJ1zI16SQ0](http://youtu.be/CRJ1zI16SQ0)

**Introduction (JS)**

Protein is an essential macronutrient in our diets, and can be found in a wide variety of foods. It is essential for growth, repair of tissues and cellular maintenance, and therefore should not be neglected in the diet. Fortunately, most people in the developed world get adequate protein to maintain proper body functioning. The problem in this culture isn’t the lack of protein; it’s the excess of dietary protein. Certain subpopulations have a general misunderstanding that more protein is better, whether it be for muscle building or weight loss. Individuals trying to lose weight will often utilize high-protein diets because of the research showing that they improve satiety. Athletes, especially resistance-trained athletes, consume high-protein diets to increase lean muscle mass. In fact, athletes regularly consume two to three times the recommended dietary protein intake, usually in the form of meats and whey protein supplements. It is not clear whether a diet high in protein can be detrimental to health.

**Protein Structure and Function (JS)**

Proteins are macronutrients, structurally similar to carbohydrates and lipids in that they contain carbon, hydrogen and oxygen. In addition, proteins contain nitrogen and sulfur. They are made up of different combinations of amino acids, linked together by peptide bonds to form dipeptides,
tripeptides and polypeptides. Polypeptide chains contain fifty plus amino acids, also known as a protein. The average-sized adult body contains between ten and twelve kilograms of protein, with skeletal muscle containing sixty to seventy-five percent of it. The remainder exists as organs, bone tissue, and plasma proteins such as enzymes, hormones, antibodies, and hemoglobin. In addition, approximately 210 grams of amino acids exist freely in the body.

Proteins have many roles in the human body. They are an essential component for every type of cell in the body, and are needed to form enzymes, hormones, antibodies, blood-clotting factors and blood-transport proteins. Necessary for building new tissues, many people assume that more protein is better, especially those breaking down muscle in a workout. This is not the case however; the amount needed depends on the rate of renewal or the stage of growth and development of the person, and an excess can cause adverse health side effects. Athletes do however, need slightly more protein than the average individual. Protein is crucial in helping repair muscle fibers damaged due to exercise, as well as helping to promote adaptations in muscle fibers. Another small role protein plays in an athlete is aiding in replenishment of energy storage that has been depleted due to exercise\(^1\).

In order to obtain many of these proteins, we need to ingest them. Twenty different types of amino acids are required for functioning, yet the human body can only synthesize eleven. The other nine, called essential amino acids, must be obtained in the diet. Foods that contain all of the essential amino acids are called complete proteins, or higher-quality proteins. Complete proteins usually come from animal sources, including foods such as eggs, lean beef and fish. Incomplete proteins are missing one or more essential amino acids, and are usually found in plant sources such as beans, nuts and cereals. Vegetarians and vegans must consume a variety of different protein sources in order to prevent malnutrition\(^2\).

**Recommended Dietary Allowance for Protein (JS)**

Protein is an essential macronutrient, but we don’t need quite as much as most Americans may think. The Recommended Dietary Allowance for protein is a guideline represented as a percentage of daily calories. The Food and Nutrition Board of the National Research Council developed the RDA, with help from the National Academy of Science. It has been revised numerous times since 1943, and the current recommendations are for an amount of protein that safely prevents any nutritional deficiencies in healthy persons. Since these guidelines are standards, they do not accurately define a specific person’s protein requirements. Protein requirements are generally increased with stress, disease or injury, as well as pregnant and nursing mothers. Athletes generally can benefit from an increased protein intake as well, but not an excess. The average person generally requires 0.83 grams of protein per kilogram of body weight per day. This accounts for ten to fifteen percent of the total daily calories\(^2\). The American College of Sports Medicine recommends 1.2 to 1.4 grams of protein per kilogram body weight for endurance-trained athletes per day, while resistance-trained athletes may need up to 1.6 to 1.7
grams of protein per kilogram body weight per day. In addition, special populations such as pregnant and nursing mothers, and infants and children should increase their protein intake temporarily. Pregnant women should intake an additional 20.0 grams of protein during the pregnancy per day, and nursing mothers should continue to have an additional 10.0 grams of protein per day. Infants and children should have about 2.0 to 4.0 grams of protein per kilogram body weight per day to help nourish their growing bodies.

Most individuals can meet their daily recommended protein intakes through diet alone, without the use of the ever popular protein supplements on the market today. The exception to the rule is those who are trying to lose fat mass by restricting calories. In this case, supplements may be beneficial to ensure that enough protein is included in the diet.

Protein Digestion and Metabolism (JS)

When we ingest a source of protein, the digestion begins in the stomach, when it stimulates the release of hydrochloric acid by the parietal cells in the gastric mucosa of the gastrointestinal tract. The hydrochloric acid is released into the lumen of the stomach where an acid-catalyzed reaction occurs. HCl activates pepsinogen to the active form of the enzyme, pepsin. Pepsin then can break down polypeptides into di- and tripeptides, and ultimately into amino acids in the duodenum. Amino acids travel through the hepatic portal vein to the liver, where they undergo deamination, the process of cleaving the amine group, to form urea. The deaminated amino acids are simultaneously processed and converted into a nonessential amino acid or a carbohydrate or fat, or catabolized directly for energy. Since the body does not store protein, metabolism of amino acids is completed within a few hours. If neither of these actions occur, urea is excreted from the body in solution as urine.
Use of High Protein Diets (JS)

The reasons for high-protein diets differ across the board. Athletes, coaches and fitness buffs may eat high-protein diets because they believe that muscle mass increases by eating high protein foods. However, this is not the case. This special population does in fact need additional protein in their diets, but not as much as they think. Athletes typically eat two to three times the recommended protein intake based on their body size, and since the body does not store protein, much of it is excreted by the kidneys. Another population that frequently utilizes high protein diets consists of people trying to lose weight. A study in the American Journal of Clinical Nutrition tested subjects on three different diets, each with varying percentages of macronutrients. The study concluded that the diet with the highest protein intake had markedly increased satiety. Therefore, someone trying to lose weight might increase their protein intake to feel fuller and curb cravings. In addition, those on ketogenic diets tend to eat a higher percentage of proteins since carbohydrates are limited.

Kidney Strain Leads to Damage (SS)

When protein is metabolized, numerous wasteful byproducts are formed. These pass through the millions of blood-filtering nephrons housed within the kidneys, which remove them from circulation and ultimately excrete them from the body through the formation of urine. The more protein that is ingested and metabolized, the harder the nephrons must work to rid the body of these waste products. Thus, chronic high-protein diets place unnecessary strain on the kidneys.
Researchers published an article in the *New England Journal of Medicine* that revealed that replacing carbohydrates with meat in dogs’ diets caused a 100 percent increase in renal blood flow and glomerular filtration rate, and feeding rats a 35 percent protein diet compared to a 6 percent protein diet caused a 70 percent increase in filtration rate. The typical Western diet, which includes about 100 grams of protein per day, is not consistent with the evolutionarily-designed digestive system and its mechanisms. The researchers assert that the increased intrarenal flows and pressures induced by such a chronic excess demand on the kidneys is a definite factor in the development of glomerular sclerosis found in both animal and human subjects.

However, protein’s effect on the kidneys appears to be non-linear; although excess protein catabolism significantly increases the burden of filtration, actual damage may not occur below a particular threshold level that the kidneys are able to sustain. This hypothesis is corroborated by a study cited in the journal *Evolution of Longevity in Animals* in which kidney patients who were kept on a 30-40 gram protein diet over the extent of two years revealed no significant impact on GFR. Furthermore, a study published in the *New England Journal of Medicine* suggests that a low protein diet of 0.73 grams per kilogram per day may be advantageous for patients with moderate kidney insufficiencies, however there were no apparent benefits for patients with severely insufficient kidney function who strictly maintained very low protein diets of 0.66 grams per kilogram per day. Should renal capacity and moreover, damage, be a function of actual amount of protein in the diet and the subsequent strain it produces, at least minimal affliction would have been reported in the former study and the benefits would align in the latter. A final three-year study cited in *Kidney Int.* that compared ‘normal’ protein diets of 1.3 grams per kilogram per day with lower protein diets of 0.58 grams per kilogram per day not only found that those subjected to the lower protein ingestion had a 28 percent lower GFR but lower blood pressure as well.

Beyond this apparent threshold of protein metabolism tolerance, notably for kidneys with known pathology, studies reveal that having to filter excess protein byproducts expedites damage and accelerates disease progression. For example, in a study of nurses that spanned eleven years, high protein intake produced no significant effect on renal function in those with normal healthy kidneys, yet it exacerbated the decline in function of those with some insufficiencies.

Perhaps most interesting is that numerous studies suggest that the source of protein may dictate how great an impact the kidneys may sustain from filtering the resultant waste products. An article in *Clinical Nephrology* reported a notably higher GFR in subjects who ingested 90 grams of protein from meat as opposed to those who obtained their protein from milk. Moreover, soy protein appears to be even less detrimental to renal functioning than milk’s main protein, casein, as a study that tested the effects of both sources’ proteins in rats indicated less damage and longer lifespans in the soy-fed animals. Researchers speculate that this discrepancy is attributable to two factors. First, the glycoprotein structure of casein is antigenic so the body is consequently
prone to reacting toward it with an immunity response. Second, the favorable one-to-one ratio at which lysine and arginine is found in soy protein (in contrast to casein’s two-to-one ratio) stimulates less insulin secretion and is thus less inclined to produce atherogenic effects.

**Chronic Acidosis Leads to Bone Deterioration (SS)**

The average American diet is high in refined carbohydrates and animal sources of proteins and low in vegetables and fruits. Such regular nutrition is known as an acid-ash diet, for when these primary sources of nutrition are metabolized during digestion, excess acid is generated. Foods that generate high levels of acidity during metabolism are considered to have a high PRAL, or potential renal acid load. These include meat and fish sources, as well as many cheeses and grains. Non-cheese dairy sources, such yogurt and milk, have a low PRAL. As fruit and vegetable sources have alkali-ash buffering capacities, they are considered as having a negative PRAL. According to Barzel and Massey, a typical high protein acid-ash American diet can yield over 100 mEq of acid each day, mostly in the forms of sulfate and phosphate.

When the body is bombarded with this excess acid, it must get rid of it in order to achieve its ideal pH environment so that optimal functioning may ensue. It thus maintains homeostasis by ridding itself of excess acid via urine. As the kidneys form urine by extracting waste products from the bloodstream, these high acidic loads must pass through them. However, the minimal pH of urine that the human kidneys are capable of excreting is a pH of five. Unchecked, this mechanism would produce massive amounts of urine; high acidity levels would have to be greatly diluted in order to meet this pH five criteria. A pH three soda, for example, would have to be diluted to 100 times its volume before it could be excreted in urine. Instead, the body efficiently utilizes basic buffers to neutralize these large unwanted acidic loads in order to ultimately excrete them. Rather than a 100-fold dilution of a one liter soda, its acid is effectively neutralized by 16 mEq of carbonate. This could be facilitated by four Tums tablets, which provide the required amount of buffers in the form of calcium salt, or it can be achieved internally by a sophisticated mechanism that utilizes bone tissue.

Bone plays a principal role in maintaining acid-base homeostasis within the body. Essential buffers are extracted from its hydration shell, or the water that encompasses bone. In fact, 80 percent of the body’s total carbonate, 80 percent of its citrate, and 35 percent of its sodium is found in these shells and utilized to neutralize excess acid. When an acid excess is experienced, the body responds with an immediate acellular physiochemical reaction in which these three compounds are released. Chronic acid exposure causes a net efflux of these essential buffers from the bones’ hydration shells and leads to depletion of these primary buffering resources. In order for the body to maintain its optimal pH homeostasis it must then turn to other sources of buffers; its preferred backup mechanism of neutralization is the mobilization of bone itself, specifically for its calcium.
Weight Gain (SS)

Weight gain is the inevitable result of consuming more energy in the form of food than expending it through daily functioning and movement. Without movement, there is a basal metabolic level that each person must sustain in order to maintain homeostasis. Activity requires additional energy; the more active a person or the more strenuous activities he or she performs, the greater caloric needs he or she has. Because food is so easy to obtain in our society, with the less-nutritious and more energy-rich foods being mass produced for cheaper costs, it is quite easy to take in more energy than one’s body requires. And, as technology is increasingly raising the levels of comfort and convenience we experience, it is equally as easy to avoid expending this extra energy. This trend, which results in the body storing this excess energy in the form of fat, has been a major battle for Americans in the past few years.

The body requires certain proportions of each of the energy-providing macronutrients - fats, carbohydrates, and proteins - for optimal functioning. When an excess amount of any (or any combination) is ingested, regardless of which one, the body stores the excess energy in adipose tissue as an energy reserve. Extra fatty acids in the bloodstream are stored in adipose tissue. Excess monosaccharides, the smallest unit of carbohydrates, are re-linked to form new fatty acids and also stored in adipose tissue.

A lot of confusion and contradictory statements exist regarding what happens when excess protein is ingested. Many nutritional advocates claim that extra protein will not lead to weight gain because the body cannot store protein and its byproducts are flushed out in the urine. It is true that the body cannot store protein in the form of its constituent amino acids and that the nitrogenous part is excreted via urine, however once the body has utilized the amount of amino acids that it needs for cell maintenance and growth, the remaining ones are either used as energy (as a last resort only if glucose or fatty acid sources are depleted) or, as excess carbs, the amine groups are removed and the remaining structures are also converted into fatty acids and conveniently stored.

Another common misconception that exists is that consuming extra protein while weight training will stimulate muscle growth or increase bulk. This is false, however, as muscle growth results from repairing microtrauma within them that results from great force exertions; the reparations result a bit thicker each time they are healed, and can only progress at the rate at which the body can fully repair them. As the muscle tissue is repaired on this microcosmic level, only the amount of extra amino acids from dietary protein required will be utilized. The rest is inevitably converted and stored as fat.

Little Information On Overconsumption of Protein
Not a lot of research has been conducted on the dangerous effects of high levels of protein supplements on humans. Many websites have provided adequate information on the different types of supplements and some even go as far as to give an estimate of how much an individual should ingest. Although providing accurate knowledge on the different dosages and types of products available is a start to informing supplement users of the dangers of high levels, it is not enough to keep those at risk safe. There is still a large lack of solutions to help inform supplement users of the risks associated with high levels of protein but some current solutions have been addressed or can be addressed through age and brand restrictions, Food and Drug Administration bills, more accurate dosages, and even by better publication of scientific studies conducted on the issue.

**RDA of Protein Based on Activity Level (DN)**

Many websites provide recommended amounts of protein or dosages supported by the Center for Disease Control or by specialists. Information provided by way of the internet is not the most reliable source but users will likely come up the proper dosage so that they can proceed safely and cautiously. When searching the Internet or talking to employees at GNC it is important to remember that these businesses might encourage the buyer to purchase unnecessary products. They may lure buyers into purchasing more than what the buyer really needs in order to make a quick profit. Sites such as livestrong.com have collected information to help inform users of the correct dosage amounts. For example, Dr. Francis O’Connor who works for the Consortium for Health and Military Performance has made recommendations on the amount of protein a person should take based on their gender and their athletic level. He has stated that for a male endurance athlete the proper dosage is 1 to 1.4 grams per pound of body weight per day while for male strength athletes the proper amount is 1.5 to 1.8 grams per pound of body weight per day.

**Protein Supplements and the Young Body (DN)**

Currently there are no age restrictions or laws in that stop young people from purchasing or using protein supplements. Children under the age of 18 can simply walk into a supplement store and purchase protein supplements, some of which may have additives other than protein. It is highly unsafe for these children's developing bodies to be able to take these supplements in excess amounts. In addition, many companies and markets create protein supplements for children with the only warning label being to consult a physician first. Some of these products include Pediagro, Pure Kidz Protein Powder, Resource Breeze, and even Resource Beneprotein which is a whey protein powder much like protein supplements meant for adults. The Center for Disease Control and Prevention has stated that most children receive at least the recommended daily requirement of protein without taking any protein supplement. They have listed that children between one and three need about thirteen grams of protein, children between four to eight need nineteen grams, those between nine to thirteen need about 34 grams while teenagers should range between forty six and fifty two grams of protein per day. Increased levels of protein...
whether through adult protein supplements or protein supplements made just for kids are extremely dangerous and can cause problems such as weight gain, toxicity, and cause a lack of other valuable vitamins. There is not any current solution to help inform families of possible health risks associated with this problem unless they conduct their own research or the subject via the internet or actually speak with a pediatrician who is informed with the associated dangers. Unfortunately none of this information is displayed on the supplement bottles.

**Chemical Effects (DN)**

There are no clear regulations on protein provided by Food and Drug Administration. The FDA has stated that individual supplement companies are responsible for the safety of their own products. In 2010 a study was conducted by Consumer Reports on the 15 most popular brands of protein supplements. Many of them, including “Muscle Milk, BSN, and GNC contain high amounts of Arsenic, Mercury, Lead, and Cadmium. These amounts are higher than what the United States Pharmacopeia has claimed to be safe”. High amounts of Cadmium has been known to cause extensive kidney damage while arsenic poisoning can quickly lead to death. While this study has been popularized in magazines, newspapers, and televisions, it has not seemed to influence extreme protein users of the dangers of high levels.

**FDA Regulations (DN)**

So far the most extreme effort to help control protein supplements is an act that is currently going through the Senate. This bill is entitled the Dietary Supplement Labeling Act of 2011. This act was brought forth by Senator Richard Durbin and was assigned to a committee on June 30 2011. It is meant to help “improve the safety of dietary supplements by amending the Federal Food, Drug, and Cosmetic Act to require manufacturers of dietary supplements to register dietary supplement products with the Food and Drug Administration and amend labeling requirements with respect to dietary supplements” As a part of this new bill, “all nutritional supplement companies will have to submit a “New Dietary Ingredient” application for each of the following: each product that is manufactured or sold, changes in serving size, changes in marketing strategy for the product, and changes in manufacturing techniques that alter any ingredient particle in any way”. Although the government may see this as a way to increase the safety of supplements and inform people of the dangers of them, many supplement users are extremely unhappy with this bill claiming that the prices of the supplements will increase and many will go off the market. It is important to note the only current legislative bill on supplements was passed in 1994 and is called the Dietary Supplement Health and Education. This act was meant to try and help regulate different supplements without the Food and Drug Administration taking direct action. It states that “Under the Dietary Supplement Health and Education Act of 1994 (DSHEA), the dietary supplement or dietary ingredient manufacturer is responsible for ensuring that a dietary supplement or ingredient is safe before it is marketed”.
the new act is passed, this would be the first concrete solution to help controlling unsafe and dangerous levels of protein supplements.

**Experimental Results (DN)**

After examining a few studies, there seems to be various conclusions as to whether high protein levels truly do cause kidney damage. Studies performed on dogs showed that high levels of protein in the diet increased the amounts of creatinine and urea excretion. They measured the Glomerular Filtration Rate, or GFR which tests how well the kidneys are working by measuring the amount of filtered fluid that is passed through them. This test requires a blood sample that measures the creatinine level and this level, along with other factors (age, gender, height, race, and weight) help determine whether kidney function is good or bad $^{12}$. In the dog experiment above, it was found that high levels of protein do cause kidney damage. In humans, high levels of protein were only found to be dangerous if the person had pre-existing kidney conditions $^{13}$. More research on this subject needs to be conducted to determine how safe protein in high amounts actually is for the body. Until then, people using protein supplements or are on a high protein diet should proceed with caution and try to stay close to the accurate dosage of protein that can be calculated in the above equations.

**Research Proposal and Self-Testing Information**

**At Home Blood Urea Nitrogen Tests (JS)**

Monitoring of protein on the clinical level can be very time consuming and uncomfortable for individuals that are capable of monitoring themselves. Clinical tests such as a urinalysis, creatine clearance, or eGFR can be expensive and aren’t necessary in otherwise healthy persons. Through proper education on the recommended daily amounts of protein for specific populations, one can simply do it at home for more convenience.

Individuals who are concerned about their protein intake can take two simple actions to monitor themselves. First, a food diary should be kept daily, noting what foods were consumed as well as the amounts. The amount of protein should be noted at the end of each entry, and compared to the daily recommended amount for the population, as discussed earlier. This is a simple way to keep track of daily protein intake, an important measurement to note. The second step would be to use a BUN test. BUN stands for blood urea nitrogen, which indicates that the test will be measuring the amount of urea nitrogen excreted in the urine. The amount of urea nitrogen is typically a fairly small, stable number. If the number is greater than the norm (7-20 mg/dL), then you can conclude that the kidneys are being stressed. This test can be done either as part of routine blood work in your local health care providers office, or through the purchase of BUN test strips from a pharmacy. These at home test strips will indicate how the strip will appear after
exposure to urine if nitrogen levels are high. If this is the case, the individual should refer to their food log and decrease protein intake\textsuperscript{14}.

**Experimental Rationale (SS)**
There are no long term studies on the effects of a chronic high protein diet. Still, high protein diets are regarded in popular culture as not only healthy but beneficial to the body. There is no concrete data to support this conclusion; In fact, some of the limited data that exists contradicts such an assertion. Other previously conducted studies that examine the effects of such a high proportion of dietary protein intake they do not take place over nearly enough time to draw any secure conclusions. The potential detrimental side effects that such a diet may cause is a serious matter that can certainly be prevented. Thus, such a long-term study is necessary to establish dietary advisories or precautions regarding the upper-hand limit of safe protein intake.

**HIGH PROTEIN DIETS CAUSE KIDNEY DAMAGE**

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**ABSTRACT (SS)**

There is a general understanding among certain populations that high protein diets are beneficial. Many health risks are associated with these types of diets including kidney problems, dehydration, nutritional deficiencies and weight gain. Currently, there isn’t much data about the long term side effects, so we will be designing a research experiment to investigate the potential effects. We will be tracking the glomerular filtration rates of NCAA Division I incoming freshman in the sport of football for 2013. An experimental and control group will be used to account for protein intake. The GFRs will be recorded and trends will be analyzed over four years. If the GFR decreases for the experimental group only, then we can conclude that high protein diets do cause kidney damage.

**INTRODUCTION (SS)**

Americans eat, on average, twice as much protein daily as required. In spite of this, high protein fad diets have surged recently and are regarded in pop culture as healthy and nutritious. There is a general misconception that because protein is so essential for proper functioning and appears to play beneficial roles in weight control and muscle gain, getting extra is a good thing. Many studies show, however, that over time, having to metabolize too much protein can be harmful to the kidneys. As very limited data exists regarding long term effects on kidney function, this
experiment was designed to assess the extent and severity of damage that chronic high-protein diets may induce.

PROBLEM STATEMENT

Overview (JS)

Americans typically consume two to three times the recommended daily amount of protein in their diets. This could cause detrimental health side effects including kidney damage and kidney failure.

Research Hypothesis (JS)

Individuals consuming more than the recommended daily amount of protein for their specific population are more susceptible to kidney damage.

OBJECTIVES AND AIMS

Overall Objective (DN)

The hope of this research proposal is to conduct a study to determine whether high protein intake really does cause kidney damage.

Specific Aims (DN)

If there is a correlation between excessive amounts of protein and kidney damage, it would be beneficial to make it common knowledge to the public as well as creating regulations for high protein usage.

BACKGROUND AND SIGNIFICANCE (DN)

Currently, there are not many tests on this topic that have been conducted on people. Because of the possibly dangerous and even deadly effects excessive amounts of protein may have, it is important for the public to know the risks associated with such a diet. There are no regulations placed on protein supplements and even children can walk into a GNC and buy protein. It is important to determine if this is in fact a problem, so regulations can be put in place if necessary.

RESEARCH DESIGN AND METHODS

Overview (DN)
In order to determine the level of kidney function in the football players, the Glomerular Filtration Rate (GFR) will be measured. The GFR quantifies how fast or slow liquids are filtered and passed through the kidneys. If the players are ingesting too much protein, the kidneys will have to work extra hard to filter out the excess byproducts. This will cause damage to the glomeruli, the functional unit of the kidneys, and reduce the rate of filtration. Should lower GFRs be reported at the end of the study in comparison to what the subjects began with, it can be inferred that kidney damage resulted.

**Population and Study Sample (JS)**

All incoming freshmen on NCAA Division I football teams in 2013 will be monitored for the duration of their four years of college play.

**Sample Size and Selection of Sample (JS)**

This sample consists of hundreds of incoming freshmen the following year from all across the country to ensure that a broad enough sample is obtained. In addition, protein intake can be closely monitored by the athlete’s sports nutritionists and recorded daily.

**Sources of Data (JS)**

Glomerular filtration rates (GFRs) can be estimated by the creatinine clearance rates (CCRs). Urine flow rates will be calculated by dividing the volume of urine excreted by the time it takes to urinate, measured in milliliters per minute. In addition, the creatinine concentration in the urine (Uc) and the creatinine concentration in blood plasma (Pc) need to be measured. CCR can be calculated by dividing Uc by Pc and then multiplying by the flow rate\(^{12}\).

**Collection of Data (JS)**

An initial CCR will be calculated for each player upon entrance to college, before alteration of diets. Throughout the four years, CCR will be calculated once per month by collecting flow rate, and creatinine concentration in both the urine and blood plasma.

**Exposure Assessment (JS)**

The risks associated with the study would include possible kidney damage to the experimental group if the hypothesis is true.

**Data Management (JS)**
Data will be collected monthly by the athletic training staff and recorded in a spreadsheet, matching CCRs with relative protein intakes.

**Data Analysis Strategies (JS)**

Graphs will be made each year to show changes in CCR which estimates GFR, overtime.

**Ethics and Human Subjects Issues (SS)**

The risks involving the possible kidney damage that may result from the athletes’ high protein diets will be clearly presented in both writing and a personal brief conducted by the researcher before the study. Potential applications of the outcome of the study, such as revealing the effects of long-term protein intake to a protein-enthused yet naive society, will be addressed as well so the subjects are aware of the implications of their participation. The subjects will then have the opportunity to ask questions and subsequently provide informed signed consent before participating.

**Timeframes (JS)**

This study will be conducted over a four year time frame and data will be analyzed at the end of those four years to make a conclusion.

**Strengths and Weaknesses of the Study (JS)**

This is the longest study to date the studies the effects of a high protein diet on kidney damage. This may show better results in terms of long term damage, which has not been shown before. On the other hand, four years may not be long enough to determine if there is an effect. This study also benefits from having a large population to study.

**Public Health Significance (SS)**

This study will provide insight into the possible health consequences that a number of populations with high protein intake may face in the long term. As these diets are currently very popular and encouraged as weight-loss friendly and even healthier than traditionally balanced diets, many are challenging the evolutionarily designed metabolic process, forcing the body to alter its natural mechanisms. As no studies exist addressing the side effects of long-term alteration of these mechanisms, it is a pioneer study from which we may extract new safer dietary precautions and guidelines.

**References:**
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**Appendices:**

**Letter to the Editor:**

Jennifer Spitzer: (The Daily Targum)

The Myth Behind Protein and Muscle Building

Trying to put on muscle? All you have to do is eat a lot of protein, right? When most people consider optimal nutrition for sports performance, they think protein. The fact is that most athletes consume two to three times the recommended dietary protein intake on a given day. Although this macronutrient is very important for growth and development in the body, it isn’t the only factor to consider. Consider carbohydrates. Carbohydrates are our most efficient fuel source during exercise, and are relied on more and more as the intensity of a workout increases. If your body doesn’t have enough carbohydrates, it has to start tapping into your proteins, your next most efficient energy source. If this occurs, you could actually be losing muscle mass – the opposite of your intention! In order to preserve lean muscle mass, it is important for athletes to consume enough carbohydrates, which amounts to about 60% of your daily caloric intake.

Let’s go back to protein for a minute. So yes, protein is still a very important part of a balanced diet. The average adult needs about 0.83 grams of protein per kilogram of body weight, while athletes need about 1.2 to 1.8 grams per kilogram of body weight. As you can see, there is an increased need for protein in an athlete’s diet due to the demands of repairing the body following exercise. Too much protein however, is counterproductive. Since the body cannot store protein, the kidneys excrete whatever is not used. This places unnecessary strain on the kidneys, as well as contributing to dehydration.

So what are you supposed to consume before and after a workout then? Before your workout, carbohydrates are best! Again, they are our main fuel source, and are able to be digested and absorbed quickly. A 4:1 carbohydrate to protein ratio will provide the most benefit in aiding a quick recovery following the workout.

Spring break is coming up soon – fuel your body the optimal way for the best results!

Stephanie Saltarelli: (The Daily Targum)

Dear Editor,

It is difficult to avoid all the hype these days regarding the role and alleged importance of dietary protein. Huge food corporations advertise the protein in their products to attract customers, chain
stores like Starbucks and Cold Stone Creamery often provide the option to add why protein into an order, and health and fitness fanatic seem to make a hobby out of trying out and stocking up on the various brands that are offered in supplement outlets such as GNC. The general population is caught up on this vague yet confident idea that protein is something like a “super nutrient” that can do the body wonders when a sufficient amount is ingested. Better yet, since the media plays it up to be so important, our society is guilty of projecting this American mentality of “the more, the better” onto our nutrition labels when deciding which foods to purchase. But how does this notion continue to thrive when so much contradictory evidence exists? And where is the other side of the argument within pop culture?

There is no denying the vital role dietary protein serves the body. As one of the three macronutrients we must ingest sufficiently each day, it is the “building block” of our very beings. It’s essential for tissue growth, renewal, and repair, and is responsible for many regulatory cell-signaling functions as well as the structures that are involved in these functions. However important, one must acknowledge that it is a single nutrient out of a plethora that the body must obtain through the diet in order to maintain smooth operations. Moreover, the diet must be balanced so that it can obtain an adequate amount of all these essential nutrients at a caloric intake that matches its expenditure. When too much protein is ingested yet a reasonable caloric intake is sustained, the body is thrown off balance and is unable to perform all its processing tasks at an optimal level. Moreover, serious side effects may result.

When protein is metabolized, the derived amino acid complexes travel through the bloodstream which is filtered of its wastes by the kidneys. Amino acids are rather large nutrients and require more “effort” on the kidneys’ part to process, if you will. An overabundance of protein in the diet thus places a large demand on the kidneys as the bloodstream is continually passing through. Over time, this strain can lead to damage and even a rapid decline in ability in those with kidney malfunctions. Furthermore, high protein diets, especially those consisting of meat and fish, produce a large acidic load when metabolized. The kidneys can only process loads of pH 5 or greater so the excess acid must be neutralized first. Under normal conditions, the body accomplishes this by extracting buffers from the hydration shell of bone. When extra acid results from extra protein, the body utilizes the calcium from bone to neutralize the remaining load. Chronic high protein diets will therefore weaken the bones.

I encourage you to address this in an upcoming issue of your magazine, as incorporating such a high protein diet into one’s lifestyle may cause grave health problems in the future. Studies have consistently shown that Americans, on average, already eat about twice as much protein as needed. It is our responsibility as knowledgeable citizens within the field to spread the facts that not only is fretting about getting more protein unnecessary, it is potentially harmful. We must strive to reveal this opposite yet substantiated side of the argument to the masses so that everyone can make more informed and healthy choices about the diets they choose to consume.
To the editors of Men's Fitness,
I'm writing to inform the readers of Men’s Fitness about the dangers of High Protein Diets. Many people choose a high protein diet because they believe the diet will help them increase muscle mass. What many people do not know is that much of the excess protein is just excreted out of the kidneys and can cause extensive kidney strain. If consuming unsafe levels of protein is continued, ketosis, dehydration, and bone deterioration will occur while the possibility of complete kidney damage does not loom far behind. For the sake of your health, it is important to know how much protein one really needs in his diet. For instance, male endurance athletes need 1.0 to 1.4 grams of protein per pound of body weight while male strength athletes need 1.5 to 1.8 grams per pound. The average American already consumes enough protein in their regular diet and exceeding these guidelines will end up hurting your body. There are currently no restrictions on high protein diets, so for the sake of your body and health please stay informed and use protein in moderate amounts!

Sincerely,
Danielle Neidich