



NSCA's

# Performance Training

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**Nutrition**

*Reinventing  
the Basics*

**Protein** Proportions

**Recovery  
Nutrition**



**NSCA**

National Strength and Conditioning Association

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# NSCA's Performance Training Journal

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**June 11 – 12, 2004**

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# FitnessFrontlines

G. Gregory Haff, PhD, CSCS

## Does Dietary Fat Affect Muscle Substrate Metabolism and Performance in Endurance Athletes?

Recently, Vogt and colleagues compared the effects of a high fat diet (53% fat) to a high carbohydrate diet (17% Fat) to explore the effects of diet on aerobic exercise performance. Eleven duathletes from Switzerland participated as subjects and ingested one of the two diets for 5 weeks. Results indicated that there was no difference in volume of mitochondria in the muscle, suggesting no compromised in oxidative capacity in response to the diet intervention. Additionally, there was no significant difference between muscle glycogen content between the high fat ( $487.8 \pm 38.2$  mmol/kg) and the high carbohydrate diet ( $534.4 \pm 32.6$  mmol/kg). Average power output during a 20 min all out time trial performed on a cycle ergometer was not significantly different between the two diet interventions. The researchers concluded that moderate to high exercise intensities were maintained and this may have resulted from a larger contribution of lipids to total energy supply.

Vogt M, Puntchart A, Howald H, Mueller B, Mannhart C, Gfeller-Tuescher L, Mullis P, Hoppeler H. (2003). Effects of dietary fat on muscle substrate metabolism, and performance in athletes. *Medicine and Science in Sports and Exercise*, 35(6):952 – 960.

## Oral D-Ribose Supplementation does not Affect Anaerobic Exercise Capacity or Metabolic Markers in Trained Subjects.

Researchers at Baylor University recently reported that the ingestion 10g/d of oral D-Ribose does not improve anaerobic performance. Nineteen trained male subjects participated in this investigation. Subjects performed two 30-second Wingate cycle tests before and after 5 days of supplementation. It was determined that the inclusion of D-Ribose did not create significant differences in peak power, average power, torque, or fatigue index when compared to a placebo supplement. Additionally, the use of D-Ribose did not significantly alter metabolic markers such as lactate, ammonia, glucose, or uric acid. Based upon these findings the researchers concluded that the D-Ribose supplementation is not warranted by anaerobic athletes.

Krieder R, Melton C, Greenwood M, Rasmussen C, Lundberg J, Earnest C, Almada A. (2003). Effects of oral D-Ribose supplementation on anaerobic capacity and selected metabolic markers in healthy males. *International Journal of Sport Nutrition and Exercise Metabolism*, 13(1):76 – 86.

## Does Caffeine Ingestion During a 100 km Time Trial Effect Performance?

Recently, Hunter and colleagues reported that the ingestion of caffeine prior to and during a 100 km time trial does not significantly alter performance. Eight highly trained cyclists consumed a caffeine and carbohydrate beverage before and every 15 minutes during the time trial. Results of the investigation revealed that caffeine consumption had no effect on average power and time to complete the 100 km time trial. Additionally, the caffeine consumption had no effect on EMG amplitude or power frequency spectrum. The results of this study lead the researchers to conclude that caffeine ingestion is not needed to maximize 100 km time trial performance.

Hunter A, Gibson A, Collins M, Lambert M, Noakes T. (2002). Caffeine ingestion does not alter performance during 100 km cycling time-trial performance. *International Journal of Sport Nutrition and Exercise Metabolism*, 12(4):438 – 452.

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# MindGames

Suzie Tuffey Riewald, PhD, NSCA-CPT, \*D

## Putting Success Within Reach

Success. Most of us strive for it, whether it is in athletic pursuits, business, diet, family life or personal undertakings. In this article, we are going to take a closer look at “success” and,

in doing so, provide you with a different way of approaching your own endeavors in an effort to enhance your opportunities for success. The two tracks we’ll take to do this are to:

1. clarify and individualize the definition of success
2. overview research on Olympic athletes to help identify factors that may influence success.



outcome with success. Consequently, we consider ourselves failures if we do not reach our “goal.” Do you consider yourself a success if you don’t achieve the desired outcome? Can one be successful without achieving a given outcome?

If we broaden our understanding of success, we can enhance our chances of achieving success. John Wooden, the legendary UCLA basketball coach, takes a different approach to defining success. He defines success as “peace of mind which is a direct result of self satisfaction in knowing you did your best to become the best you are capable of becoming.” This definition is certainly less restrictive in that it focuses on effort put forth. This approach to understanding success takes the emphasis off of the outcome and suggests that success can be found through the process or journey. Success can be achieved by anyone and is irrespective of the final outcome. An individual would be successful if she committed to lifestyle changes necessary to manager her weight, regardless of the actual number of pounds lost.

### Defining Success

There are a variety of ways to conceptualize and understand success. How you define success will have a significant influence on how you achieve success. According to Webster’s dictionary, success is “a favorable or desirable outcome.” This definition focuses solely on the outcome. For most individuals, this is the definition of success that is embraced. That is, we strive to achieve a sought after outcome, such as bench pressing 250 lbs, running a sub-20 minute 5k or losing 10 lbs, and we equate this desirable

How do you define success? Is your understanding and interpretation of your own success inclusive such that effort and outcome are taken into account?

### Identifying Factors That Influence Success

Watching most elite level athletes perform, most of us shake our heads in awe at what they are able to do. We often attribute the

successes of these individuals to being blessed with exceptional talent; genetically drawing the long straw. After all, how else could they accomplish such amazing feats?

Interestingly, this question was put forth to Olympians. Specifically, Olympians from 1984 – 1998 were asked to identify the factors that contributed most to their successes. While these athletes identify “natural talent” as a factor influencing success (ranked #6), numerous other factors are ranked as more important. As we look at these factors, determine if these factors can influence you as you strive for success and think about how you can apply them in your life.

The top 4 factors that Olympic athletes attributed their success and some questions to asked yourself are identified below:

- 1. Dedication and persistence**—These Olympians believe that these positive qualities had a significant impact on their successes. When you encounter obstacles, do you still persist? Are you committed to the pursuit of your goals? Are you determined to succeed?
- 2. Support of family and friends**—Success isn't achieved alone. A network of individuals provides various types of support that the Olympians believed to be critical to their individual success. Who provides support to you? Who are the individuals you can rely on to provide physical or emotional support, to provide you with balance?
- 3. Excellent coaches**—Coaches provide much needed expertise, knowledge, insight, skills, etc needed in the accomplishment of goals. Who are the “coaches” that can help you achieve your goals? A personal trainer? Nutritionist? Business mentor? Surround yourself with excellence.
- 4. Love of sport**—The foundation of the Olympians' athletic pursuits was a passion for the sport; a love for what they are doing. Do you enjoy what you are doing? Note that an earlier Mind Games article addressed strategies you can implement to bring the joy back to your athletic endeavors.

As a parting suggestion, take some time to consider what success means to you and look at the factors that you feel positively influence your success. Are you limiting yourself by how you define success? Are there areas of your life that need cultivating to help promote success? As you perform this exercise, hopefully you will identify areas that can improve your success.

## About the Author

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# Training Table

Debra Wein, MS, RD, LDN, NSCA-CPT

## Protein Proportioned Properly... *Finally!*

The effect of exercise on dietary protein requirements has been a controversial topic for years. Despite the debate, many athletes have routinely consumed extremely high protein diets with the hope of increasing size, getting cut, and gaining muscle mass. Indeed, protein performs extremely important functions in the body as part of enzymes, hormones, antibodies (in the immune system), and components of tissue, especially muscle tissue. However, more protein in the diet does not necessarily mean more muscle on the body.

Over the last 30 years, the protein debate has fueled quite a bit of research, and it has now become clear that regular exercise does in fact increase protein needs—good news for athletes who thought this was the case all along. On the other hand, the interpretation of what the increase should be is extremely variable. In fact, what a lot of athletes fail to realize is that the typical American diet contains excess protein, so that most exercising individuals obtain sufficient protein without any extra effort.

### How much protein is enough?

Although muscle is indeed made of protein, eating excess amounts will not cause muscle hypertrophy or growth. Muscle stimulation and contraction, through strength training, causes muscle hypertrophy and eating extra carbohydrate—stored as glycogen—fuels intense strength training workouts. Without adequate glycogen, you cannot contract optimally and hypertrophy will be limited, whereas, consuming carbohydrates supports both glycogen and protein synthesis through the insulin response (insulin, an anabolic hormone, is produced in response to carbohydrate intake).

Scientific studies suggest that the protein intake for those who engage in regular, intense strength building exercise should be 0.4 – 0.8 grams per pound of body weight (212 – 225% of the current RDA, or Recommended Dietary Allowances). To determine your protein needs, multiply your body weight by the conversion factor found in Table 1, this will give you the grams of protein you need per day.

### So what should you eat?

When eating, read food labels and use Table 2 to track the number of grams of protein you eat each day. Do this for a few days to figure out your typical protein intake and make adjustments in your diet accordingly.

### Bottom line

The best plan to build muscle, increase strength, and bolster performance is to work your muscles hard and fuel them optimally with a diet adequate in protein, high in carbohydrate, and low in fat.

**Table 1 - Protein recommendation based on activity**

Activity Level	Conversion Factor
Sedentary individuals/ Sporadic exercisers	0.4 grams per lb. body weight
Active exercisers	0.5 – 0.6 grams per lb. body weight
Very active exercisers	0.7 – 0.8 grams per lb. body weight

**Table 2 - Protein content of food groups**

<b>Food Group</b>	<b>Protein (g)</b>	<b>Calories</b>
<b>Dairy – nonfat and low fat</b> 1 cup milk; 1/3 cup dry milk; 1/2 cup evaporated milk; 3/4 cup yogurt	8	90 – 120
<b>Meat and Meat substitutes</b> 1 oz. lean meat, poultry, fish, shellfish; 2 egg whites; 1/2 cup cooked beans; 1 oz. low fat cheese	7	35 – 55
<b>Starch</b> 1 slice bread; 1/2 cup pasta; 1/3 cup rice; 1 small potato	3	80
<b>Vegetables</b> 1/2 cup cooked or 1 cup raw	2	25
<b>Fruit</b> 1/2 cup juice or 1 piece raw	0	60

## Suggested Reading

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# The Reinvention of Nutrition Basics

Anthony A. D'Assisi, BPHE, CSCS, RNCP

Just when you thought you had nutrition figured out, another book on how we should eat for optimal bodyweight and health is on the shelves disputing everything you once believed. If you keep up with the latest health and fitness trends, you have heard of The Atkin's Diet Revolution, Protein Power, and countless others like them. The similar thread these diets share is the claim you will lose weight and become a healthier person by restricting carbohydrates and replacing them with a higher consumption of protein and fat. For short-term weight loss these diets usually work, not because you are omitting a food group, but because you are severely restricting your caloric intake. Therefore, you are depriving your body of one of the main fuel sources it relies on for energy. Since every microstructure of our remarkable human bodies is affected by total nutrition, we must re-evaluate the basics of nutrition for bodyhealth success.

For many years, we were taught the best method to rely on for a healthy body was to eat in moderation from the various food groups on the food guide pyramid. However, an article in a recent issue of Newsweek claims the 1992 food guide pyramid is now widely viewed as flawed. The pyramid is far too simple and does not make clear distinctions between good and bad carbohydrates, and similarly between good and bad fats<sup>1</sup>.

The article entitled "The Perfect Diet," examines Harvard's Healthy Eating Pyramid. The new and improved pyramid, developed by Dr.'s Stampfer and Willett from the department of Nutrition at the Harvard School of Public Health, focuses on individual foods, promotes good carbohydrates and fats, and has physical activity and weight control as the foundation level.

Basic nutrition begins with an understanding of the six major nutrients our bodies need to thrive. These six nutrients are carbohydrates, protein, fat, vitamins, minerals, and water.



## Carbohydrates

Carbohydrates are composed of a mixture of three atoms: carbon, hydrogen, and oxygen (CHO). These atoms can be linked together in different ways and numbers to form various types of carbohydrates. There are three main variations: 1) complex carbohydrates, 2) simple carbohydrates, which are stored as glycogen (the fuel that supply our bodies with energy) in the liver and muscles, and 3) fiber which contains non-digestible cellulose that gives plants their shape.

Complex carbohydrates are the large branched chains formed by many sugar molecules linked together. This is called a starch, and includes whole grains, vegetables, fruits, legumes (soybeans and kidney beans for example), seeds, and nuts. These are considered the "good" complex carbohydrates, whereas the white bread, white rice, pasta, and potatoes would be the "bad" carbohydrates. A more detailed look at starches and the glycemic index (GI) can give us a better idea as to what makes a carbohydrate good or bad. A basic chart of carbohydrates with their glycemic values is shown on the next page.

Basic Glycemic Index Chart			
High Glycemic Index "Bad Carbohydrates"		Low Glycemic Index "Good Carbohydrates"	
Maltose (beer sugar)	110	Whole rice	50
GLUCOSE <i>Glycemia Marker</i>	100	Whole wheat bread	50
White bread	95	Whole wheat pasta	45
Instant potatoes	95	Fresh white beans	40
Honey, jams or jelly	90	Oatmeal	40
Cornflakes, popcorn	85	Whole rye bread	40
Carrots	85	Green peas	40
Refined sugar	75	Whole grain cereals	35
Corn	70	Dairy products	35
Beets	70	Wild rice	35
White rice	70	Fresh fruits	35
Cookies, pastries	70	Lentils	30
Boiled potatoes	70	Chick peas	30
White flour pasta	65	Dried beans, peas	30
Bananas	60	Soya (most)	15
Raisins	60	Green vegetables	<15

The glycemic index (GI) is a numerical system of measuring how fast a carbohydrate triggers a rise in circulating blood sugar. A GI of 70 or more is high, a GI of 56 to 69 is moderate, and a GI of 55 or less is low. So a low GI food will cause a small rise, while a high GI food will trigger a dramatic spike.

It doesn't tell you how much of that carbohydrate is in a serving of a particular food. Simply stated, a "bad" carbohydrate increases the potential for the hormone insulin to be released more readily and in larger amounts. Conversely, the "good" Carbohydrates cause the release of lower amounts of insulin. Insulin promotes fat synthesis (production) from glucose in the liver, and fat storage in adipose tissue by blocking fat release from adipocytes (fat cells).

Simple carbohydrates, such as sucrose (table sugar), are the smallest unit or molecule of carbohydrate. One gram of carbohydrate, whether complex or simple, will yield four calories of energy when burned up by our cells. The importance of this fuel lies in how the body absorbs these two different molecules, their effect on our blood sugar and the secretion of insulin. Most people should consume approximately 5 – 10 g/kg. Generally this translates to 55 – 60% of one's daily intake of carbohydrates.

The third variation of carbohydrate is fiber, the carbohydrate our bodies cannot digest. The value behind this is the fact that fiber acts as a sweeper of our intestines, keeping them free of harmful substances and potential cancer-causing chemicals. Most North American diets only achieve 8 – 12 grams of fiber per day. In a recent study, an intake of 30 grams per day was associated with a decrease in heart disease and cancer<sup>2</sup>.

The authors of the high protein diets are trying to persuade us to change our eating habits by eliminating carbohydrates. But as the previous discussion shows, they are neglecting the importance of this food group, which includes the "good" carbohydrates and fiber.

## Proteins

Protein is a very important nutrient since it is in every cell in our body and is the primary structure that composes our muscles. However, it should not be the nutrient we eat in place of a healthier balanced nutrition plan that includes good carbohydrates as well.

Protein is a more complex mix of atoms when compared to carbohydrates. This is because of the addition of nitrogen to the carbon, hydrogen, and oxygen mixture. However, one gram of protein, similarly to one gram of carbohydrate, will also yield four calories of energy when burned up by our cells.

Proteins are made up of amino acids, of which there are twenty-two. Eight of these amino acids are considered dietary essentials, and two others are considered as semi-essential. They are considered essential because our bodies cannot produce them, and therefore they must be acquired through the food we eat. It is important to note that the reason we eat protein sources is not to provide the body directly with protein. Rather, it is to supply the body with the amino acids it requires to make its own proteins.

With sufficient amounts of carbohydrate available to meet energy demands, the channeling of protein for energy is spared and this protein-sparing effect helps regulate protein metabolism.

As in the case of the high protein diets, if the body has a level of protein above the body's needs, the excess is burned as fuel. There is a benefit of a higher amino acid blood concentration, and that is the release of the hormone glucagon. Glucagon has an effect opposite to that of insulin: it increases the release of free fatty acids from adipose tissue<sup>3</sup>.

Unfortunately, the burning of proteins is not as clean as the burning of carbohydrates. This is due to the nitrogenous waste accumulation mainly in the form of urea. This waste has to be handled by the body and puts extra stress on the liver, kidneys, and urinary tract.

Many people ask, “How much protein should I eat?” General recommendations range from 0.4 – 0.9 g/kg depending on activity level. However, current research suggests between 0.8 g/kg for the average sedentary individual, up to 1.7 g/kg for a strength athlete who runs 70 miles per week or performs daily heavy resistance exercise<sup>4</sup>. On average, this equates to 12 – 15 % of your daily caloric intake.

## Fats

Lipids are most commonly known as fats, oils, waxes, and related compounds that are not soluble in water. Fats are primarily a mix of carbon, hydrogen, and oxygen atoms. They differ from carbohydrates because they have fewer oxygen atoms present. One gram of fat will yield 9 calories of energy when burned by our cells.

All fats have both saturated and unsaturated fatty acids. The degree of saturation of fat depends on how many hydrogen atoms are present, and whether it is liquid or solid at room temperature. In general, the saturated fatty acids are worse for the body because they are artery clogging. These fats usually come from animal sources and are solid at room temperature. When a pair of hydrogen atoms are missing from the fatty acid it is usually monounsaturated, if more are missing it is polyunsaturated. Just as there are essential amino acids, there are essential fatty acids. These are the polyunsaturated fats or Omega 3 and Omega 6 fatty acids. These are the “Good Fats” that are necessary for body metabolism, and cannot be manufactured by the body, so they must be supplied in the diet. These essential fatty acids can be found in foods like sesame seeds, olive oil, wheat germ, sardines, and salmon to name a few.

There is another “Bad Fat” structure related to the unsaturated fatty acids (called the trans fatty acids or TFA’s) that has been getting a lot of publicity lately. A recent study of 80,000 nurses showed that the risk of developing heart disease almost doubled for every 2% increase in consumption of TFA’s<sup>5</sup>. Trans fatty acids are fats produced by heating liquid vegetable oils in the presence of hydrogen. This process is known as hydrogenation. The more hydrogenated an oil is, the harder it will be at room temperature. It can be found in products such as margarine, cookies, doughnuts, french fries, fish sticks, and even baby cookies. Soon there will be a change in food labeling making it easier for consumers to understand how many grams of TFA’s are in the foods we buy.

After a high-fat feeding that may occur when on a high-protein diet, there is an inadequate amount of carbohydrate available for energy needs, and the excess fat is oxidized or metabolized forming ketones. If these ketones are allowed to accumulate, the condition known as ketoacidosis occurs, putting stress once again on the kidneys which try to rid the body of the intermediate waste products of protein and fat metabolism.

While fat is a necessary nutrient, too much can lead to obesity, heart disease, and cancer. Limit the fat in the diet to 30% whereby 10% or less is from a saturated source. On an average 2000 calorie diet this is 45 grams of “good” fats, and 20 grams of allowable saturated fat.

## Vitamins & Minerals

Vitamins are organic compounds with no caloric value, but are used to help regulate metabolic reactions in the body. They cannot be synthesized by the body and therefore must be obtained through the diet or supplementation. Vitamins can be divided into two specific groups, water-soluble and fat-soluble. The water-soluble vitamins (B complex, C, and the bio-flavonoids) are absorbed directly into the blood stream and are not stored in the body. For this reason it is important to replenish them daily. The fat-soluble vitamins (A, D, E, and K) require fats/oil to be absorbed. When too many fat-soluble vitamins get stored there is a potential for toxicity. Therefore it is crucial not to “megadose” with vitamins A, D, E, and K.

Minerals are simple chemical elements that also cannot be synthesized by the body. There are sixteen different minerals, some are major (if your body requires 100 mg/day or more), and some are trace (required intake under 100 mg/day). They are used as non-protein substances to assist enzymes in their functions, and serve as building materials for bones, teeth, tissue, muscle, blood, and nerve cells.

## Water

Without food you could survive for almost two months, but without water you’d be lucky to last two weeks. The general recommendation for the consumption of water is eight to ten eight ounce glasses per day. Post-exercise, the body can handle up to eight ounces of fluids every twenty minutes or so. It is suggested that ingested fluids be cooler than ambient temperature (between 15° and 22° C or 59° and 72° F), with the addition of the proper amount of carbohydrate and electrolytes if the activity is longer than one hour<sup>6</sup>. Water loss of 9 – 12% of your bodyweight can be fatal. Second only to oxygen, water is the most important element the body needs to survive.

## Conclusion

Since each and every human being is biochemically unique we still need to learn how to more accurately discover an individual’s peculiar needs. The Reinvention of Nutrition Basics has given you at least a rough idea as to what the nutrition essentials are for healthier eating. To make up for any deficiencies and to ensure you get the proper mix of carbohydrates, protein, fat, vitamins, minerals and water, it’s necessary to eat from every food group in the new and improved Food Pyramid each day.

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## About the Author

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# The Wonders of Whey Protein

Marjorie Geiser, RD, NSCA-CPT

Until about 1980, about half of all the whey produced was dumped as waste product into local waterways. However, two events took place to change how whey was addressed: First, more strict environmental laws were forbidding regular dumping of industrial byproducts; and second, researchers started to investigate all the benefits of using whey, which created a new source of revenue. This article will discuss the many benefits of whey protein products, and what the research says about how it can benefit those involved in strenuous exercise.

Many active people today have heard of whey protein, but many may not know exactly what it is. Whey is the thin, watery portion of milk that is obtained by coagulation and removal of the curd (casein) during cheese production. The whey proteins are then separated from the liquid whey and purified to various concentrations of whey protein. Not only are whey products used in such foods as baked goods, toppings, salad dressings, and emulsifiers, they are also used as high-quality protein sources in energy bars, protein powders, infant formulas, and medical nutritional formulas.

Whey contains almost all the vitamins and minerals of milk. Alfa- and beta-lactalbumin comprise between 70 – 80% of whey. These provide high levels of essential amino acids and branched chain amino acids (BCAA). Many of the individual components found in whey can now be isolated to carry out specific needs or can be further added to commercial whey products.

It is felt that, when comparing whey protein to casein, whey is a superior product. Whey appears to offer more benefits to the immune system, is digested and absorbed faster, is a higher-quality protein, and may have better antioxidant properties.

Whey also appears to exert more beneficial effects than soy protein as whey offers a more complete protein and does not inhibit absorption of other nutrients. Research has shown that eating soy foods can be beneficial to a healthy diet because they supply the body with what are known as phytoestrogens or isoflavones. However, when these substances are concentrated, as when in supplement form, it is believed that too much of a good thing may actually be harmful to your health. Therefore, consuming soy in forms other than as food is not recommended at this time.

There are several forms of whey protein (see Table 1):

- *Whey powder* is produced by taking the whey directly from cheese production, clarifying it (removing fat), pasteurizing it, and drying it to provide a fine white powder.
- *Whey protein concentrate* typically uses what is called ultra filtration technology to filter or concentrate whey components. Ultra filtration basically causes the larger protein molecules to remain while filtering out lactose and ash, which results in a higher concentration of protein. Although the concentration of protein can range between 25 – 89%, most products contain at least 80%.
- The highest concentration of protein comes in *whey protein isolate*. These products have a protein concentrate of 90% or higher as a result of both micro filtration and ion exchange. Micro filtration is much like the above-mentioned ultra filtration, except the filter is smaller. To get higher protein concentration, additional lactose and fat are removed. This process maintains the naturally occurring bioactive components present in whey that are mentioned below. Because this form of whey is so low in lactose, those who are lactose-intolerant can often safely take this product.

**Table 1**

<b>Typical Whey Protein Ingredient Composition</b>			
<b>Whey Components</b>	<b>Whey Powder</b>	<b>Whey Protein Concentrate</b>	<b>Whey Protein Isolate</b>
<b>Protein</b>	11% to 14.5%	25% to 89%	90% +
<b>Lactose</b>	63% to 75%	10% to 55%	0.5%
<b>Milk fat</b>	1% to 1.5%	2% to 10%	0.5%

Many sports nutrition products, infant formulas, and medical nutritional formulas use products with hydrolyzed whey protein. The process of hydrolysis breaks down the protein into smaller segments called peptides. Peptides are small chains of amino acids. This makes the protein easier to digest and reduces the potential for allergic reactions.

High quality whey protein powders are available in all forms, combined with many other ingredients or found as just plain whey protein. Other ingredients found in whey products are creatine, extra BCAAs, and glutamine. Many are sweetened with sugar, artificial sweetener, or an herbal sweetener known as Stevia. Some also have added flavors, such as vanilla. Whey protein isolate provides the highest yield available, but this does not necessarily mean it's a superior product over whey protein concentrate. In fact, many products contain both. Most products supply an average of 20 grams of protein per serving, but this can vary greatly, depending on the product and its goals. Ultimately, taste will determine a person's favorite product. The most common way to use the powders is by adding to fruit or juice to make a smoothie, or to add it to foods such as cottage cheese.

Most recommendations for the amount of whey protein intake depend on the individual needs. Most research does not support a total protein need higher than 0.6 – 0.9 grams per pound of body weight and an intake of 25 grams of whey protein appears to be adequate to fit these needs, along with a healthy diet.

Probably the most researched and used benefit in eating whey protein is to the immune system. Numerous studies have shown that whey proteins, which are high in the amino acid cysteine, help enhance the body's immune system by raising glutathione levels<sup>1</sup>. Glutathione is a powerful antioxidant with the ability to help the body reduce the risk of infections by making the immune system more responsive. Antioxidants help fight against disease. Commonly known antioxidants are vitamins, such as vitamin C, E and A.

One of the largest organs responsible for fighting disease is our gastrointestinal tract. The intestinal tract is a diverse bacterial universe that consists of more than 400 different species of bacteria, each with multiple strains. While both harmful and

friendly bacteria coexist in this environment, it's very important for our overall health that the beneficial bacteria dominate. These beneficial bacteria, known as probiotics, are responsible for keeping the gut healthy. Typical examples of probiotics are *Lactobacillus acidophilus* and *Bifidobacterium lactis*. Most people are familiar with these products in the form of yogurt and kefir.

Prebiotics are substances that promote the growth and activity of these beneficial bacteria. Two common examples of prebiotics are fructooligosaccharides (FOS) and inulin, which are non-digestible carbohydrates that act as a food source for the probiotics. Whey proteins have been found to also improve intestinal health by way of their prebiotic value. Components of whey that act as prebiotics include the immunoglobulins, lactoferrin, glycomacropeptide (GMP) and dietary calcium.

Immunoglobulins (Igs) are probably the best-known of these agents. Igs are basically proteins responsible for the body's antibodies, who act as soldiers fighting against pathogens. Examples of Igs are IgG, IgM and IgA. IgG has been shown to bind to the toxins that cause infections leading to diarrhea, dehydration and muscle aches.

Lactoferrin (Lf) is another element that works as a prebiotic. As an iron-binding protein, studies show that this protein survives passage through the stomach and small intestine and is able to seize iron from bacteria in the lower bowel. Since many pathogens have high iron requirements, this property of Lf makes it broadly antimicrobial (capable of destroying or inhibiting the growth of microorganisms) in nature.

Whey protein is a popular protein supplement for fitness primarily because of its high concentration in the branched chain amino acids (BCAAs), leucine, isoleucine, and valine. BCAAs are needed for the maintenance of muscle tissue and appear to preserve muscle stores of glycogen, the storage form of glucose<sup>2</sup>, and may help prevent muscle protein breakdown during exercise<sup>3</sup>. Consequently, taking whey as the protein source for pre-exercise and post-exercise, along with a carbohydrate source, may exert a beneficial effect to the training muscles.

A consistent finding in research has shown the immune-boosting benefits of whey. A review by Ha and Zemel<sup>4</sup> concluded that the most significant benefit of taking whey products in exercise was in improved immune function. Several published reviews of the literature concluded that more research is still needed to determine the benefit of amino acid supplementation in exercise training<sup>5,6</sup>.

Studies on other benefits of whey protein to exercise are mixed. When comparing whey protein and exercise to exercise alone in women with HIV, Agin et al<sup>7</sup> found that whey protein had little effect on muscle mass, but did improve quality of life, which again substantiates the immune-enhancing benefits. However, another study showed increased lean tissue and bench press strength when subjects combined whey protein with creatine.

However this combination did not show greater results for squat strength and quadriceps strength<sup>8</sup>. So, combined with other ergogenic aids, whey may offer some athletes a competitive edge.

There are many other benefits to whey protein intake beyond the focus of this article, but are worth mentioning:

1. Whey protein is a key ingredient in many infant formulas because alpha-lactalbumin is the main component in human breast milk
2. Alpha-lactalbumin is high in tryptophan, a natural relaxant. A recent study showed that a diet including alpha-lactalbumin-enriched whey protein was helpful in improving mood levels and increasing serotonin levels in the brain<sup>9</sup>.
3. Some studies suggest that whey protein may provide benefits to people with borderline high hypertension. Many studies are currently in progress on this topic.
4. Whey protein shows promise to help fight many cancers through its glutathione antioxidant system (GSH)<sup>1</sup>.

So, the often seen statement that whey is an 'ultimate protein' doesn't appear too far off the mark. It can supply an easily digested, complete protein for replenishing the muscles and help boost the immune system as a bonus! It appears to have superior qualities over casein and soy products, and it is widely available. For someone looking for the best protein source to supplement their diet, this would probably be my first recommendation.

**A great idea for a home-made smoothie after a workout is to combine in a blender:**

- 1 cup nonfat soy milk
- 1 scoop of whey protein powder (any kind)
- 2 tablespoons ground up flax seeds.

Turn blender on for a short second to combine ingredients. Then add between 1 – 1½ cups frozen mixed berries and blend until you have the consistency you want. Further sweeten to taste.

This will provide between 23 – 50 grams protein, approximately 35 grams carbohydrate, 0 – 3 grams fat, about 6 grams fiber from the flax seeds, and around 250 calories. These totals may vary, depending on the products used.

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## About the Author

Marjorie has an extensive background in nutrition and exercise. She started teaching exercise classes in 1980 and was the manager of a small health club before returning to school. In 1990, she graduated from Loma Linda University with a degree in Nutrition & Dietetics. In 1996, she started MEG Fitness to provide in-home personal training for older, previously unfit older adults and nutrition counseling, primarily sports nutrition and functional nutritional therapy. She is a Registered Dietitian (RD) and a personal trainer, certified through NSCA. She is currently the secretary for NSCA's Personal Trainers SIG.

# Recovery Nutrition

Scott Josephson, MS

**C**an you relate to this? You are finishing a really hard workout and the primary thought in your mind as the workout winds down is “now I’m going to relax.” So once the workout is completed, that is exactly what you do. Once you’ve finished your physical training, you are still not finished training. How well you recover today will be a huge factor in how well you perform tomorrow. You must consider the recovery process as part of your training process. If you give equal emphasis to the recovery part of your training as you do the actual training, you will enhance your performance tremendously and keep yourself as healthy as possible.

We’ve all heard about the “window of opportunity” that’s present immediately after a workout. Optimally, an athlete needs to take advantage of helping the body “refill the tank.” Your body will adapt to the training you’re putting it through by storing more glycogen, its primary fuel source. This adaptation process is allowing you to put your system through another strenuous training session, and be more prepared by having a reservoir of available fuel. It makes perfect sense to replenish essential nutrients shortly after a workout when the body’s supplies have been depleted or exhausted. If you do not recover properly, you will not be ready to perform well during your next training period.

Optimally, you want to rid your muscles of lactic acid and other waste products. Proper recovery will allow you to restore nutrients, get rid of lactic acid, and refuel energy storage. Intense physical activity is likely to lead to a severe depletion of carbohydrate stores (glycogen) and dehydration. It is important to start replenishing carbohydrates soon after exercise. Also, glycogen synthase, the enzyme that controls glycogen storage, is highly active immediately after exercise when muscle glycogen stores are low.

The amount and type of carbohydrate used for recovery will depend on various circumstances, but there are advantages to liquid forms. Liquid forms are more convenient, can satisfy thirst, require minimal preparation, and are extremely portable. Sports drinks that are formulated specifically for recovery are less likely to contain large amounts of protein, fat, and fiber. These can slow gastric emptying, and impede the recovery process. Fluid replenishment is a vital component of post-exercise recovery.

Water and electrolytes are lost through sweat, and glycogen and protein must be replaced as quickly as possible to ensure that the athlete is ready for the next workout. You can jump start the muscle recovery window by consuming a sports drink containing electrolytes, carbohydrates, and protein. The nutrient content of the drink will result in smaller nutritional deficits after the workout. For the most part, sports drinks have been formulated to contain carbohydrates and electrolytes, however some of the newer drinks now contain protein and antioxidants as well. Sports drinks that offer approximately 14 grams of carbohydrates per 8 ounces are best. This carbohydrate level delivers the optimal amount of both energy and fluid to aid in recovery. Sports drinks that contain mostly fructose can slow down absorption and cause stomach cramps. It is best to look for drinks with a higher percentage of fast-absorbing carbohydrates such as glucose, sucrose, and maltodextrins with approximately 100 milligrams of sodium. A carbohydrate solution (6% – 8%), rather than plain water, will maintain a sufficient concentration of blood glucose and help sustain a high rate of recovery.

Carbohydrates, vitamins, and minerals all play important roles in recovery. Many foods that contain carbohydrates, protein, and a small amount of fat are excellent for helping with recovery. By taking in ample amounts of carbohydrates immediately after training, and again within the next three hours, athletes can get a head start on refueling their muscles after workouts. Carbohydrates are essential in rebuilding muscle cells, and for boosting the production and release of insulin from the pancreas. Insulin is an anabolic hormone that has a positive impact on protein synthesis in muscles, and tends to suppress protein breakdown. Muscle cells are highly receptive to insulin, the hormone responsible for transporting glucose and amino acids

through the blood stream and into the muscle cell. Consuming carbohydrates within 30 minutes of completing an intense workout will synthesize twice as much muscle glycogen as if you wait several hours before refueling. Essentially, the two most important components of recovery are replenishing the glycogen fuel burned during the workout, and rebuilding the muscle proteins that are destroyed. The sooner we begin, the better chance of recovery for the next training session.

During intense workouts, muscle protein is damaged, which leaves an athlete with a net loss of muscle protein. Similar to glycogen synthesis, protein rebuilding proceeds much faster in the first 2 hours following intense exercise. It has been suggested that the optimal formula for post-exercise nutritional recovery be 4 grams of carbohydrate for every 1 gram of protein<sup>1</sup>. I agree with this formula, and have utilized it with many athletes with whom I consult. The 4:1 ratio of carbohydrates to protein maximizes insulin release, and maximizes the rate of glycogen/protein synthesis.

Generally speaking, a person can consume approximately 1 gram of protein per every 10 pounds of body weight, within an hour or so of completing an intense workout, and approximately 4 times that amount of carbohydrates. Many athletes who I have worked with were consuming way too much protein, and not enough carbohydrates after their training sessions. It is important to realize that more carbohydrate than protein is burned during your workout. Consuming large amounts of protein will slow down gastric emptying and severely alter the muscle recovery window. Carbohydrates and proteins may result in a greater stimulus for muscle glycogen storage. Optimizing the muscle glycogen storage has important implications for athletes that are exercising intensely. Since the purpose of post-exercise feeding is to replace the muscle glycogen and protect lean body mass, athletes must replace adequate calories that were lost. The amount needed depends on the size of the athlete, the degree of carbohydrate depletion, and the severity of fluid loss. Overall, carbohydrates eaten immediately post-exercise, are rapidly stored in the muscles as glycogen. These carbohydrates give stressed muscles the fuel needed to speed up the recovery process.

Electrolyte replacement is also crucial. Athletes can replace these electrolytes by consuming fruits, vegetables, sports drinks, as well as other foods and beverages. Electrolytes help control the energy used for normal bodily functions, including muscle contractions. Replacing electrolytes is an extremely important part of nutrition recovery, as performance can be severely altered if adequate levels of electrolytes are not present. The solution for proper electrolyte replenishment during intense exercise is to do it gradually so it does not override normal body mechanics. In other words, do not try to replace all the fluids at one time, as this can lead to hyponatremia (over diluted blood sodium levels). Electrolytes are beneficial by maintaining a proper balance of sodium, potassium, and magnesium that help prevent muscle cramps during and after exercise.

Remember, even after your workout is completed, there is still work to do. Putting these principles into practice will help lead you in the right direction, and enhance your recovery process.

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