

The Biology of Athletic Performance: What Every Athlete Needs to Know

If you're like most competitive athletes, you're always looking for an edge. You invest countless hours of training into improving your athletic performance by a just few minutes (or even seconds). You spend hundreds—if not thousands—of dollars upgrading your equipment and hope that all those nutritional supplements, protein powders and recovery drinks are actually doing 'something.'

Now there's a better way to measurably improve your athletic performance—without any guesswork and for just a fraction of the cost and time.

How?

By simply getting to know your body and providing for its basic, biological needs.

Most athletes would agree that staying well-hydrated is a biological necessity. After all, being dehydrated by just one percent could easily add five minutes to your next 10K. That's a significant drop in performance!

But adequate hydration is just one of many variables that can work for (or against) you. And while it's an important one, there are a number of other factors that play an even greater role in determining not only how well you perform, but how quickly you recover and how fit you feel.

These biological factors have been identified because they either control or influence a number of other physiological variables which determine your body's maximum performance potential. When optimized, they will increase the energy, function and balance of every system in your body.

Do the foods you eat provide your body with the fuel it really needs?

Is your body overly acidic?

Are your mineral levels balanced?

Are your iron stores adequate?

Do you know your essential amino acid status?

Are your essential fatty acid ratios correct?

Are your levels of vitamin D optimal?

Is your hormonal recovery system strong?

Chances are, you probably don't know the answer to all of these questions. And you might not understand why they're all that important to ask.

This report was created to familiarize you with the basic, biological processes at work inside your body and to help you understand just how critical they are. Understanding—and providing for—the unique, biological needs of your body is the single, most-important thing you can do to improve not only your athletic performance, but your overall health and well-being.

For more information on how you can find your edge, talk to your Bioletics affiliate coach or trainer. Or visit www.bioletics.com.

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Metabolically-Appropriate Fuel

Every athlete is a genetically and metabolically unique individual with specific nutritional needs. In today's society, most links to 'ancestral' diets have been lost due to the globalization of foods, the loss of seasonality in the food supply chain and the blending of genes through cultural intermarriage. Still, *every individual retains a genetic memory of the particular foods and nutrients that are optimal for their health and performance.*

Eating for Performance

Just as one athlete may thrive on a high-carbohydrate meal of bagels and juice, another would falter as their body requires more protein and fat and the avoidance of certain grains (such as wheat).

If you are truly interested in optimizing your performance and well-being, one of the most important steps you should take is to determine your metabolic type. Knowing your metabolic type will help you determine which foods represent an optimal fuel source for you.

If the foods you eat are not metabolically-correct, it is likely that you will experience one or more of the following symptoms:

- Your energy level may suddenly drop.
- You may still experience hunger even though you are physically full.
- Following a meal, you may crave sweets.
- You may feel nervous, angry or irritable after eating.
- You may feel 'down' or depressed after eating.

Generally speaking, following a metabolically-appropriate diet will create lasting and measurable improvements in your physical energy, mental capacity and emotional well-being. There are three primary metabolic types:

- Fast Oxidizers
- Slow Oxidizers
- Mixed Oxidizers

Fast Oxidizers feel and perform better by eating meals that are lower in carbohydrates and higher in proteins and fats. Ratios vary from as little as 40 percent protein and 30 percent of each fats and carbohydrates to as much as 50 percent fat and as little as 10 percent carbohydrates.

Slow Oxidizers normally feel and perform their best eating mostly carbohydrates. However, even Slow Oxidizers need to reduce the amount of grain-based carbohydrates in their diets, focusing instead on eating more vegetables, legumes and fruits.

Mixed Oxidizers have both Fast and Slow Oxidizer needs. While Mixed Oxidizers will enjoy the most variety in food choice, they will also face the greatest challenge in determining their ideal protein/fat/carbohydrate percentages. As a result, they will initially need to monitor their performance and well-being after eating various combinations of foods more closely.

Determining Your Metabolic Type

Surprisingly, it is relatively easy to determine your metabolic type. Most athletes are already somewhat aware of what foods make them feel and perform well. But in order to pinpoint your specific dietary needs, it will be necessary to complete a comprehensive, online questionnaire. Your results will include specific food recommendations and ratios that will allow you to fuel your body for optimum athletic performance.

Proper pH Balance

In order to perform well, your body must be alkaline. But because almost every metabolic process—from breathing to digestion, to the production of energy—all create acid as a by-product, maintaining the proper alkaline/acid balance is a constant and ongoing battle.

Inadequate mineral intake, the sweat-induced loss of calcium and magnesium, stress (both physical and psychological) and the intake of acidic beverages (including coffee, tea, soda, juice milk and energy drinks) all disrupt the body's blood chemistry. When your cells and tissues are overly-acidic, you are more likely to:

- Fatigue more quickly and recover more slowly.
- Find it difficult to concentrate.
- Have difficulty setting and working toward goals.
- Suffer from frequent colds, flus, allergies and/or respiratory problems.
- Experience chronic muscle soreness and/or joint pain and stiffness.
- Feel depressed or pessimistic.

Life is Pretty Basic!

pH (which stands for the power of hydrogen) is a measure of how acidic or alkaline a solution is. pH values are determined according to the amount of dissolved hydrogen ions (H⁺) existing in the solution. The pH of pure water at 25°C (77° F) is very close to 7.0. Solutions with a pH less than 7.0 are said to be acidic; those with a pH greater than 7.0 are said to be basic or 'alkaline.' pH measurements are important in medicine, biology, chemistry, food science, environmental science, oceanography and many other disciplines of study—including sports performance.

From a purely scientific standpoint, we know that the origins of human life can be traced to an alkaline environment—the ocean. Today, the human body's internal environment remains alkaline, with an ideal pH registering just above 7.0. When it comes to sports performance, it is important to note that *every system in the human body functions at its fullest capacity in an alkaline environment.*

There are countless chemical interactions taking place inside the body that are necessary for maintaining life. These interactions can occur only when the body's internal pH is correct. As a result, the body maintains a complex system of acid/alkaline checks and balances. To maintain the alkaline state that is necessary for ideal health, the body will go to great lengths in order to buffer or neutralize the acidic by-products of metabolic activity.

Many of the body's organs and systems, particularly the kidneys and lungs, play an important role in maintaining proper pH. The lungs excrete acids as carbon dioxide; the kidneys excrete acids in direct proportion to the amount of acidity that results from our dietary and lifestyle choices. Typically, your body will become overly-acidic when:

- You eat too many acidic foods.
- You experience chronic stress and/or are exposed to environmental toxins.
- Your mineral levels are depleted or imbalanced and you cannot eliminate acids properly.

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When fed a well-balanced diet rich in fruits, vegetables, nuts, seeds and 'whole' foods, the body will have the ample supply of the alkaline minerals it needs for buffering excessive acid. Under these optimal dietary conditions, the kidneys are able to maintain the correct acid/alkaline balance in proper proportion. However, we tend to eat a very sub-optimal diet—one that is high in acidifying foods such as animal proteins, refined carbohydrates, caffeine and processed foods.

An acidic diet creates an internal acidic state to which the body responds by extracting calcium and other alkalizing mineral salts from the blood, tissues and bones. As these alkaline reserves become depleted, every system in the body becomes compromised. And as physical function is reduced, athletic performance will decline.

Assessing and Monitoring Your pH

Normally, the rate of acid excretion through the kidneys gives urine a pH that falls somewhere between 6.75 and 7.25. By measuring the degree of acidity in your urine, it is possible to determine if your body is processing a higher-than-normal amount of acid. If your acid excretion rate is higher than normal, your urinary pH will be lower (more acidic).

Urinary pH values will vary from day to day based on your level of hydration and your dietary, exercise and lifestyle habits. For optimum accuracy, it is best to check the pH of your first morning urine and that about an hour following your evening meal on a daily basis (with a pH test strip) until you see a definite pattern develop. In order to obtain the most accurate results, wait 48 hours after a race or hard training effort to measure the pH status of your urine.

Readings below 6.5: At first, most people will have low pH readings due to the acid-forming nature of their diets. In this case, increasing the amount of vegetables, fruits, root crops, nuts and seeds eaten will be necessary. The goal is to derive 80% of your total nutritional needs from these alkalizing foods.

Readings above 7.5: A highly-alkaline reading is likely due to catabolism (the breakdown of body tissue) which triggers excessive nitrogen in the urine. If you are consistently getting readings above 7.5, it will be important to pinpoint the cause of and take steps to reverse this catabolic cycle.

Restoring and Maintaining an Alkaline State

The restoration of a health-enhancing alkaline state is essential for not only for optimum athletic performance, but for the regeneration of bones and tissues and the maintenance of a strong immune system.

In general, most athletes should be consuming about 70-80% alkaline foods and 20-30% acidic foods. However, the proportion of alkalizing foods may need to be greater when bringing the body back into balance, or when recovering from an injury or illness.

Alkaline foods include leafy greens and most other vegetables and fruits; avocados, almonds and a variety of nuts; and healthy oils like coconut and olive oil. Acidic foods include most meats and poultry; white bread and pasta; alcoholic beverages, energy drinks and sugary foods.

It is important to note that while there are many pre-fabricated lists available that describe the alkaline/acid nature of particular foods, these do not take into account an individual's unique

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metabolic response to them. For example, meat may not cause as strong an acidic reaction in a 'fast oxidizer' as in a 'slow oxidizer.' And keep in mind that it is not necessary to calculate your exact acid/alkaline food balance ratios. Once you determine your personal metabolic type, you can take logical steps to balance the overall alkaline/acid content of your meals. A turkey burger (acidic) eaten with sliced tomatoes, avocados, and a bit of olive oil drizzled on top (the last 3 items are all alkaline) would represent a balanced meal.

Unfortunately, we don't always have complete control over what we eat at every meal, so the use of an alkalinizing supplement like K Alkaline/Super Alkalinizer (available at www.bioletics.com) can play a powerful role in creating a healthy alkaline state within the body. Maintaining healthy essential fatty acid, mineral and vitamin D levels also contribute to increased alkalinity.

When making dietary changes, be patient and be persistent. Your pH indicates how deep your body's reserve of alkaline minerals is. It can take time to build up or re-balance this reserve. Don't be discouraged if your progress toward reaching ideal alkaline balance is slow. It may take a number of months to establish optimal pH levels. Your efforts, however, will be well-rewarded when it comes to long-term performance results.

Mineral Balance

Inadequate mineral intake, the sweat-induced loss of calcium and magnesium, physical and mental stress and the intake of acidic beverages (which typically contain a high sugar or simple carbohydrate content) cause the body to extract the essential minerals it needs from the bones and tissues in an effort to maintain proper blood pH. The combination of mineral loss and over-acidity can drastically reduce your body's ability to perform and recover. It will also drastically increase your chances of suffering from rapid bone loss and stress fractures.

Because you are an athlete, your daily diet must contain adequate amounts of macro minerals. In fact, when it comes to supporting the myriad biochemical processes happening inside the athletic body, they are an absolute necessity. These minerals include calcium, chloride, magnesium, phosphorus, potassium, sulphur and sodium. The most important of these are calcium and magnesium. (Iron, which is another absolute essential, will be discussed in the next section.)

Calcium helps to neutralize acidity, clear toxins, build bones and increases alkalinity and flexibility. Magnesium is required for energy production, mental function and strong bones.

Get Ready for Shock!

Beyond weaning age, children and adults of various countries and food cultures subsist on diets differing markedly in their calcium content. And perceived 'deficiencies' based on these differences appear to have no negative health consequences. The average daily calcium intake for a black South African, for example, is 196 mg; the daily calcium intake for the average African American is more than 1,000 mg. Yet the hip fracture rate among African Americans is *nine times greater* than that of the South Africans! And those countries with the highest calcium consumption turn out to be the same ones with the highest rates of osteoporosis.

While we have all been told to drink milk, eat dairy products and take calcium supplements in order to improve our teeth and bones, the idea that there is a health benefit associated with simply adding more calcium to our diets is a fallacy. Even a National Dairy Council study proved that the more milk women drank, the more bone loss they experienced.

Why?

The underlying problem is not a lack of calcium; it is keeping calcium in the bones. Calcium will be extracted from bone when we are deficient in key nutrients, especially vitamin D, magnesium and vitamin K. In addition, our diets lean toward being acid-forming and many athletes (including elite swimmers and cyclists) do not incorporate enough weight-bearing activity into their exercise routines. Finally, stress depletes our hormonal system which, in turn, triggers a loss of calcium from the bones.

Magnesium: The King of Minerals

Magnesium is a trace mineral necessary for nearly every bodily function. It is one of the most critical elements in our bodies and the single most important mineral to sports nutrition. About 350 enzyme functions depend on it, including the production of ATP (which generates energy for every, single cell).

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Despite magnesium's pivotal role in energy production, many coaches and athletes remain unaware of its critical importance in maintaining health and performance. *Optimal magnesium levels enhance athletic endurance and strength by increasing metabolic efficiency and decreasing oxygen consumption.*

Among other things, magnesium regulates active calcium transport; it helps the body absorb calcium. In fact, the body cannot process calcium without magnesium. Due to its pivotal role in controlling cardiac muscle contractions and rhythm, low magnesium levels often contributes to the sudden and pre-mature death of young athletes.

Most people do not get enough magnesium in their diets, especially if they eat large amounts of processed foods. As an athlete, you should strive to eat natural, magnesium-rich foods. Even a simple change like eating more whole grain products and boosting your intake of vegetables, nuts and seeds can make a difference. Keep in mind, however, that altering your diet will probably not be enough.

Because you are an athlete, you will lose magnesium faster than the average person. Naturally, you will sweat more. And when you sweat, you are losing more than just water. You are losing electrolytes, principally sodium and magnesium. Sweat-induced magnesium loss is accelerated in hot and humid conditions.

Those who regularly use coffee, sugar, table salt, alcohol, cola and tobacco and those who suffer from excessive levels of physical and mental stress, chronic pain, low thyroid and diabetes are particularly prone to magnesium deficiency.

Evaluating Your Mineral Status

While it may seem easy enough to assess the levels of magnesium and calcium found in the blood, it is not. Blood levels of these particular minerals decline only when their bodily stores are extremely low.

A better functional assessment of mineral balance that takes into account both alkaline/acid status and calcium/magnesium balance begins with examining a marker of bone turnover called NTx. Bones are living tissues that are constantly breaking down (resorption) and rebuilding (formation). When bones break down faster than they can rebuild, they excrete high amounts of a molecule called NTx. A simple urine sample is all that's needed to measure the amount of NTx found in the body. When levels of NTx are excessive, it means that bone is being broken down too quickly and that there are mineral imbalances in the body that need to be addressed.

Restoring Mineral Balance

Restoring optimal levels of magnesium can be a somewhat arduous process. In the early days of human evolution, magnesium was abundant in the food supply. As a result, the body did not develop a magnesium absorption or conservation mechanism as it evolved. As a result, the vast majority of oral magnesium supplements (tablets and capsules) are poorly absorbed. Topical magnesium oils and gels and oral angstrom minerals are—by far—the most effective, absorbable forms of magnesium available. For more information on these products, please visit www.bioletics.com.

Iron/Ferritin

Iron is another critical mineral necessary for optimum athletic performance; it is the mineral responsible for carrying oxygen from the lungs to the tissues. Less than optimal levels of iron can lead to significant performance declines. It is important to realize that athletes do not have to be anemic (deficient in red blood cells) in order to be suffering from low iron. Symptoms of low iron include:

- Poor performance and slow recovery
- Exercise fatigue and/or lethargy
- Increased heart rate
- Heavy legs
- Susceptibility to infection
- Irritability
- Ice cravings
- Reduced mental capacity (difficulty concentrating on or remembering things)

Why Do Athletes Need Iron?

Iron is an essential part of the hemoglobin molecules found in the red blood cells. Without an adequate supply of hemoglobin in the blood stream, less oxygen will reach the muscles. *If your muscles do not have enough oxygen, your VO₂ potential will be significantly reduced.*

An athlete can have low iron levels without having reduced hemoglobin levels or suffering from anemia. Since iron is utilized to make the enzymes used for oxidative energy production, sub-optimal iron levels can still have a significant and direct impact on an athlete's ability to perform at his or her peak.

Ironically, iron can either help or harm you. If you have more iron than what your body needs to satisfy your hemoglobin requirement (for cell oxygenation), the rest becomes a surplus. And because your body has a limited capacity to excrete iron, its build-up in your body can become toxic.

Processed foods that are fortified with iron and multivitamins containing iron can contribute to iron overload. High iron levels are far more prevalent among men than women. There is also typically some genetic predisposition associated with the development of high iron.

In general, both male and female athletes are susceptible to low iron because:

- **Their total blood volume is greater.**
Participating in endurance sports will increase an athlete's total volume, enabling his or her heart to pump more blood per contraction to the lungs for oxygenation. The red blood cells themselves, however, can become diluted—and become less effective in transporting oxygen from the lungs to the muscles.
- **Their dietary iron intake is not sufficient.**
Iron is found in food in two different forms—heme and non-heme. Heme iron (which makes up 40 percent of the iron in meat, poultry, and fish) is well absorbed. Non-heme iron (which accounts for 60 percent of the iron in animal tissue and all the iron found in fruits,

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vegetables, grains and nuts) is less well-absorbed.

The typical endurance athlete eats a high-carbohydrate, low-fat diet that contains little red meat (a prime source of absorbable heme iron) and/or inadequate amounts of the foods rich in non-heme iron such as leafy greens (especially spinach), legumes and dried fruits.

- **Iron is lost on with every foot strike.**
The force of the foot hitting the ground causes a significant breakdown of red blood cells. This is particularly a problem for court sport athletes and high-mileage runners.
- **Iron is lost through sweat and urine.**
Although a relatively small amount of iron is lost through the sweat and urine, athletes who have a propensity to sweat heavily or train regularly in hot, humid conditions are pre-disposed to suffering from low iron.
- **Iron is lost through the gastrointestinal system.**
Loss of iron can occur in some athletes via small bleeds in the stomach or large intestine. While this is not a health risk, the chronic blood loss can contribute to a cumulative depletion of iron.

Assessing Your Iron/ Ferritin Levels

Paying attention to the symptoms of iron deficiency is a critical first step in identifying a potential problem. But the only way to know for sure is to have your iron level assessed.

Ferritin is the single, most useful marker when it comes to measuring your body's iron stores. Ferritin is a specific protein found inside the cell that is responsible for iron storage. Optimal laboratory ranges for ferritin are 50-70ng/ml. Training and/or racing performance times are typically* effected when ferritin levels drop below 25ng/ml. When athletes suffering from a deficiency work to increase their ferritin levels above 35ng/ml, they usually experience a rapid turn-around in performance.

Thanks to recent advancements in laboratory testing technologies, your iron/ferritin levels can be assessed with just a few drops of blood from a simple finger stick.

Restoring Iron Levels

The best strategy is to avoid low iron by preventing it. How? By eating a metabolically-correct diet and by maintaining both optimal vitamin D and essential amino acid levels.

As a general guideline, pre-menopausal women need about 15mg of iron per day, while men and post-menopausal women require about 10mg. Because endurance athletes will have a greater need for iron, their specific requirements will vary.

Foods especially high in iron include red meat, dark poultry, eggs, dark green leafy vegetables, legumes and dried fruit. For a special treat, try dried apricots dipped in dark chocolate. Below are some additional tips that can make a big difference when it comes to maintaining or re-building your iron levels:

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- Don't drink coffee or tea with meals. The tannic acids in these beverages will reduce iron absorption.
- Try to drink beverages high in vitamin C with your meals, especially grain-based meals. The ascorbic acid will counter the iron-blocking effect of the phytic acids (which interfere with iron absorption) found in non-sprouted grains.
- Use cast-iron cookware. Not only will you enjoy a richer food taste and reduce your exposure to the harmful chemicals found in non-stick pans, you will increase your iron intake (especially when cooking something acidic like spaghetti sauce).

For those who are found to have low iron/ferritin levels, typically 36mg daily of an iron supplement will be need. Many OTC iron supplements, however, are poorly absorbed or tend to cause constipation. A protein bound or a liquid angstrom iron supplement (see www.bioletics.com for additional details) is the preferred method of supplementation. Because the minerals are in an ionic water-based form Angstrom minerals are quickly and fully absorbed by the body.

Please note:

Having an iron level that is too high can be even worse than having one that is too low. Do not take iron supplements unless you have had your iron/ferritin levels assessed. Even then, iron need only be taken if levels are less than 30ng/ml and/or dietary adjustments have not successfully restored levels to at least 40ng/ml.

Restoring a low ferritin level may not always have a dramatic effect on performance. For some athletes, a low ferritin level may only be a warning sign of impending anemia. By restoring their levels to an optimal state, however, they will have taken a positive step in preventing both hemoglobin loss and performance declines.

Essential Amino Acids

Proteins are made from building blocks called essential amino acids. The lack of just one essential amino acid not only reduces the body's ability to build and maintain muscle, it can interfere with the production of key digestive enzymes, neurotransmitters and hormones.

Training and racing damages the structural proteins of the body. This damage is what causes soreness after a hard effort. To repair itself, the body needs essential amino acids. *About 75% of all athletes are deficient in at least one essential amino acid and, as a result, fail to recover quickly or completely.*

Amino Acids in the Athlete's Body

While many athletes calculate their protein needs based on their weight and physical activity level, the body does not really have a protein requirement. It has an essential amino acid requirement. Once digested, the dietary proteins we eat are broken down into amino acids. These amino acids are then reassembled by the body into protein structures that are more easily used at the cellular level.

Amino acids are responsible for the formation of proteins found in every tissue of the body. They also play a major role in nearly every chemical process that affects cellular energy production as well as physical and mental health. As a result, amino acids have more diverse functions than any other nutrient group. A few of these include the formation of:

- Ligaments, tendons, and bones
- Immune antibodies
- Enzymes and blood transport proteins
- Hormones (thyroid, melatonin and growth hormone, among others)
- Neurotransmitters (such as adrenalin, dopamine, and serotonin)
- Skin, hair and nails
- Enzymes utilized for the digestion of food

There are 22 amino acids found in the foods we commonly eat. Eight of these are called 'essential' because without them, we cannot make the other 14.

Because athletes demand more from their bodies, their need for essential amino acids is greater. Those suffering from a serious injury or illness also have higher essential amino acid requirements. Without a sufficient supply of amino acids, the body cannot repair itself.

It is commonly believed that one protein source is just as effective as another when it comes to building or repairing tissue. But when we closely examine the different types of available protein, we find that this is not the case.

Every type of dietary protein contains a different blend of the 22 amino acids. Some, however, have a higher 'biological value' than others; they have a better balance of the eight essential amino acids that enable our bodies to re-assemble usable proteins from them. The best examples of these are organic grass-fed meats, wild fish, poultry and whole eggs.

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Other foods have a lower biological value meaning that they have a poor mix of the eight essential amino acids; it is more difficult for the body to re-assemble them into usable proteins. Examples of these are whey, soy, beans, nuts, and egg whites.

Vegetarians and athletes who rely on protein bars and powders that are whey, soy or casein-based may be surprised to find out that these proteins—regardless of the sales hype—are not well utilized by the body. In fact, while almost 40% of whole eggs are used anabolically (for growth and repair), only 18% of most powdered proteins are.

To complicate matters, even those who eat high biological value proteins may not be able to digest them fully due to an insufficient supply of stomach acids or digestive enzymes, which decline as a result of stress and with age.

Evaluating and Restoring Your Amino Acid Levels

The current status of your essential amino acid levels can be determined with just a few drops of blood from a simple finger stick.

The vast majority of athletes (endurance athletes, in particular) are amino-acid deficient because they either do not eat enough high-quality protein or because they cannot digest and/or absorb it. As a result, it makes sense for anyone interested in improving their performance and well-being to supplement their diet with a balanced essential amino acid formula that does not require digestion and can be directly utilized to manufacture usable proteins.

It is important to know that not all amino acid supplements are created equal. Most do not have the needed ratio of all eight essential amino acids along with artificial flavors, colors, preservatives and non-nutritive fillers. Bioletics', proprietary essential amino acid formula, offers a unique blend of the eight essential amino acids, that is 100% utilized by the body and four times more effective than protein powders when it comes to providing the body with what it needs to build strong muscles and bones and maintain healthy enzymatic, hormonal and recovery functions. And completely natural and filler-free! (see www.bioletics.com for additional details)

Balanced Levels of Essential Fatty Acids

Fats and oils are comprised of building blocks called fatty acids. Essential Fatty Acids (EFA's) are fatty acids, omega-3 (linoleic) and omega-6 (linolenic), that your body needs but cannot make.

These EFA's serve many functions in the body. *No cell, tissue, gland, or organ can work properly without them and optimal levels are critical in reducing inflammation, increasing endurance, shortening recovery, protecting joints, lifting mood, improving concentration and promoting deeper sleep.*

The Importance of EFA's in the Metabolic Process

EFA's are the key components of the body's cellular membranes. Without EFA's, our cells would not remain fluid and flexible. Because the body is constantly repairing itself from cellular damage, it demands a cell membrane that will allow the continuous flow of nutrients in and toxins out.

EFA's are important in every metabolic process, including energy production. They maximize energy release and are an essential component of the breakdown of large molecules used to fuel physical output. They are important in oxygen transfer and hemoglobin (red blood cell) production. And they significantly reduce recovery time because they encourage the blood to bring vital oxygen and other nutrients to muscle cells, while enabling those cells to be more open to receiving their important delivery.

Finally, EFA's are essential in the formation of intra-cellular, hormone-like substances called prostaglandins. Prostaglandins are vital for a variety of functions including muscle relaxation, anti-inflammatory action, temperature regulation and blood flow. They also elevate testosterone and growth hormone secretion, both of which support physical repair and recovery.

Evaluating your EFA Status

EFA's started to disappear from our diet about 75 years ago and now have disappeared almost entirely. Only about 20 percent of the amount needed for human health and well-being remains as a consistent part of our normal diet. Due to an unfounded fear of healthy fats and the unfortunate amount of unhealthy fats in our commercial food supply, most Americans consume too few natural Omega-3 fats (fish, grass-fed meats, flax, walnuts and hemp and pumpkin seeds) and too many processed Omega-6 fats (corn, soy, canola, and safflower oils). These changes have led to a global, performance-reducing imbalance in our Omega-6 to Omega-3 EFA ratios. In fact, the ratios of the average American are *extremely unbalanced* (between 10:1 and 25:1). Optimal ratios lie between 1:1 and 3:1.

Since it is impossible to accurately predict an individual's EFA status due to a number of different variables (age, weight, gender, dietary choices, lifestyle habits, metabolic rate and digestive absorption rates), EFA levels must be assessed. The process is quite simple and requires just a few drops of blood from a simple finger stick.

EFA assessments are used to measure the amount of fatty acids found on the red blood cell membrane, the exact ratio of Omega-6 to Omega-3 fats and the total amount of Omega-3 fats present in the body.

Restoring Balance

As athletes, our EFA status becomes stronger when we eat foods that are similar to those eaten by our primitive ancestors: Lean meats, eggs, antioxidant-rich fruits and vegetables, and natural unprocessed fats with a high Omega-3 to Omega-6 ratio (flax, walnuts and hemp and pumpkin seeds) along with the moderate use of healthy fats such as olive, coconut oil, ghee and fresh butter. The trick is to learn the difference between the 'good' fats and the 'bad' ones—and to eat the right balance of Omega-3 and the Omega-6 fatty acids.

The richest source of pure Omega-3 fatty acids is cold water fish. However, just eating more fish doesn't guarantee you will get enough EFA's. Many species of fish have low levels of EFA's and cooking can destroy a large portion of them. Most people will find that they will need to use EFA supplements in order to achieve optimal EFA status. Good sources include purified fish oils and krill oil.

Vitamin D

Based on recent research, we now know that:

- Regular exposure to the sun enables the body to produce optimal levels of vitamin D.
- Vitamin D may be the single, most-important factor influencing your performance and well-being.
- Vitamin D is both an important building block and a necessary cellular activator of almost every physical process— from the immune and hormone systems to those regulating brain and bone health.
- Almost 75% of all athletes have less than optimal vitamin D levels. And the vast majority of them aren't even aware that they are deficient.

Power from the Sun

Vitamin D is not actually a vitamin as it is produced when the sun's UVB rays come in contact with the skin. Technically, vitamin D is a hormone made by the skin from fat-soluble nutrients naturally found in the human body.

Vitamin D regulates the expression of more than 2,000 of the 30,000 human genes. It is an essential part of the endocrine system as it controls several adrenal hormones, the growth rate of cells and the production of enzymes. It is also a powerful immune booster. Vitamin D provides a front-line defense against colds and flus and works to prevent both cancer and auto-immune disease. Vitamin D deficiency has been linked to myriad illnesses including heart disease, diabetes, depression, attention deficit disorder and autism.

The evidence is very clear that the farther away from the equator you live, the higher your risk of developing cancer, an auto-immune disease or a number of other serious illnesses is. In short, those who live at higher latitudes have significantly higher disease rates than those living in lower latitudes; there is a direct correlation between disease rates and the amount of available sunshine in a geographical area. The cancer rate in Scandinavia, for example, is 90 per 100,000 people each year. In the Tropics, the rate drops to 25 per 100,000 people each year.

Vitamin D is also critical for optimal athletic performance as it promotes muscle strength and recovery while enhancing both reaction time and balance. In order to understand how vitamin D may impact your athletic performance, it is important to remember that the active form of vitamin D is actually a hormone that acts, in many ways, like testosterone or growth hormone. ***It acts directly at the cellular level encouraging optimal growth, repair and performance.***

Overwhelming evidence suggests that restoring vitamin D levels can dramatically improve athletic performance. One study, for example, showed that five minutes of UV exposure three times a week improved cardiovascular fitness scores by 19 percent (compared to 2 percent for a control group). Another study showed that athletes' 100-meter dash times were improved from 13.63 to 12.62 seconds with the use of UV lamps. Additional research indicates that athletic performance is seasonal; it peaks when vitamin D levels peak and declines as they decline. This may explain why many athletes who leave a winter climate to perform against athletes living in a summer climate do not perform as well.

Vitamin D Deficiency is Pervasive

The probability that you are vitamin D deficient is very high. One recent study found that even in sun-drenched areas such as southern Arizona, vitamin D deficiency is common. In fact, more than a vitamin D.

Even if you live and train in a perpetually-sunny environment but work indoors and don't make a conscious effort to spend the correct amount of time outside (without sunscreen and at the right time of day), you can—and probably will—become vitamin D deficient.

Assessing Vitamin D Levels

It is absolutely essential that you get your vitamin D levels assessed regularly (a simple finger stick is all that's required) to insure your levels are adequate. Also, while the body will not produce more vitamin D than it needs, it is possible to take too much vitamin D orally. Optimal levels of vitamin D fall within the range of 50-65 ng/ml (nanograms per milliliter).

How to Optimize Your Vitamin D Levels

We are only beginning to realize what our bodies have intuitively known for thousands of years: The sun provides us with tremendous healing and performance potential. Restoring optimal vitamin D levels with regular and managed exposure to UV light and/or oral supplementation is one of the most important things you can do for your athletic body.

The best way to raise your vitamin D levels is not with supplements, but by exposing your bare skin to sunshine. However, getting sun exposure is not always practical or possible. During the winter months, or whenever sun exposure is not a realistic option, oral supplementation with vitamin D3 (cholecalciferol) should be considered.

Sun exposure (without sunscreen) of about 10 to 15 minutes a day, with at least 40 percent of your skin exposed, is the general guideline to follow, although people with dark skin will need significantly longer periods of exposure. The use of a safe tanning bed (one that has its harmful emissions shielded) to encourage your own body produce its own vitamin D is another possible option.

It is important to understand that in the summertime, when you are able to sunbathe, your body can naturally produce about 20,000 IU's of vitamin D—the same amount of vitamin D in 200 glasses of milk or the equivalent of that found in about 50 multivitamins. Your body requires 4,000 IU's daily, just to maintain its current vitamin D level.

In order to actually increase your levels, you will need to either increase your amount of exposure to the sun or take an oral vitamin D3 supplement. Due to individual absorption patterns, oral tablets and gel caps are unreliable in restoring vitamin D levels. Sublingual vitamin D sprays are much more effective and allow for more precise dosing when compared to both capsules and tablets. Bioletics' Vitamin D Nanospray features a patented delivery system that allows for consistent and reliable dosing and absorption. (see www.bioletics.com for additional details)

Stress and Recovery Hormones

As athletes, we want our bodies to have a positive anabolic to catabolic ratio. In simple terms, anabolism is the process of growth and repair. Your anabolic state is at its highest during your teenage years. Catabolism is the process of breakdown and destruction. Your catabolic state is at its highest after a period of intense training and/or racing, after an injury or during an illness. The catabolic process naturally increases as we age.

Our testosterone to cortisol ratio provides us with an indicator of our anabolic to catabolic balance. This ratio applies equally to both male and female athletes.

Testosterone

Testosterone is an important hormone for both men and women. It plays a key role in promoting muscular growth and repair. It also controls the body's utilization of amino acids, directing them to the muscles in an effort to generate optimal power during (or recover fully from) a hard effort. Testosterone contributes to your ability to stay focused, motivated and positive.

Cortisol

Cortisol is a major steroid hormone produced by the adrenal glands. It enables the body to cope during times of stress. Without a proper cortisol response, you will not be able to effectively meet the challenges of daily life.

Cortisol levels naturally increase in the morning and fall at night. If this rhythm is disrupted, your mineral balance, immune response, blood sugar levels and stress response will be negatively affected. While a lack of cortisol can lead to fatigue, allergies and arthritis, too much cortisol can create even more serious health problems.

While short-term elevations of cortisol are important for dealing with the anxieties of day-to-day life, common illnesses and wound healing, chronically-elevated levels of cortisol are extremely harmful to your health. Elevated cortisol levels will not only leave you feeling tired and depressed, but can lead to accelerated aging and encourage the onset of muscle loss, bone destruction, obesity and diabetes.

The Effect of Stress and Training on the Testosterone/ Cortisol Ratios

Testosterone levels (among both men and women) decline with age and there is little that can be done to prevent this from happening. Testosterone levels also decline in response to stress and training. Luckily, these effects can be controlled and modified.

As we all know, stress is an unavoidable part of life. Surprisingly, even your efforts to stay fit and healthy create physical (and sometimes psychological) stress. The more intense the training, the more stressful it is. While a threshold level of stress is necessary to elicit the positive changes that athletes want from their training (such as increased muscle mass and power, a stronger cardiovascular system, and increased endurance), 'over training' creates a negative physiological response. Signs of over training include an elevated resting heart rate, loss of appetite, lethargy, weight loss and irritability.

The Biology of Athletic Performance: What Every Athlete Needs to Know

Over training also effects the body's hormonal system as it promotes the production of increased amounts of cortisol and DHEA (both are adrenal hormones), in an effort to help you adapt to and cope with the increased stress load. Unfortunately, your body was designed to adapt to acute, life-threatening stress, not the chronic, long-term stress of continual training cycles and life in the modern world. Because of this, the body can easily become overwhelmed and incapable of producing the appropriate amounts of cortisol and DHEA.

Research shows that testosterone levels temporarily decrease as a result of overtraining, while serum cortisol levels increase. In one study, runners' and cyclists' testosterone levels decreased by 50 percent while their cortisol levels increased by 300% following an intense competition.

The primary role of cortisol is to help mobilize energy for the body by increasing the rate of protein synthesis or breakdown. However, cortisol also works to impede the entry of amino acids into muscle cells for protein synthesis and, instead, diverts them to the liver where they are converted into energy. The amino acids, therefore, are no longer available for supporting or repairing the muscles.

Other negative effects of elevated cortisol levels include:

- The loss of bone mass through increased calcium excretion and decreased calcium absorption.
- Adverse affects on tendon health.
- An increase in magnesium and potassium excretion, which commonly leads to muscle cramps.
- An increase in insulin resistance, which can cause hypoglycemia and/or related blood sugar imbalances.

Unbalanced testosterone to cortisol ratios can lead to disastrous results for an athlete. The more educated you become about training efficiently (less is sometimes more), the greater your health and performance gains will be.

Assessing and Managing Your Testosterone/ Cortisol Balance

Your testosterone and cortisol levels can easily be assessed by collecting a morning saliva sample. The results of this assessment will provide you with a 'snap shot' of your anabolic/catabolic state. Periodic follow-up assessments will allow for the fine tuning of your training program, and can help you avoid training plateaus and breakdowns.

Athletes struggling with hormonal imbalances and recovery issues should strive to optimize all their key biological factors, modify their training programs and consider the use of a restorative formula.

Bioletics offers both a hormone-free oral formula containing proprietary blend of herbal concentrates and minerals as well as two topical DHEA products designed for both men and women that are more quickly absorbed into the blood stream and used more effectively by the body. Both of these products were designed to promote enhanced sports performance and recovery by supporting the body's natural ability to replenish its stores of testosterone and DHEA.

Please note: While DHEA is a safe, all-natural supplement, it can be converted in small amounts to testosterone and therefore has been banned for use by many professional and elite athletic organizations.

Biological Assessments and Collection Techniques

Traditional laboratory testing relies heavily on veni-puncture (venous blood draws), which can be quite expensive and are certainly not very pleasant or convenient. Fortunately, a variety of alternatives to traditional veni-puncture have become more readily available. The assessments included in Bioletics' Personal Performance Profiles rely on the following methods of sample collection and assessment:

Finger Stick Blood Spot Collection

This process, which may very well be the future of all blood-based assessments, requires one or more drops of blood from a nearly-painless finger stick. ***Blood spot assessments provide results that are just as accurate as those from veni-puncture.*** In addition, they are much less costly and much more convenient. And several assessments can be performed from a just single drop of blood.

Saliva Collection

Salivary collection procedures are inexpensive, non-invasive and allow for precisely-timed measurements throughout the course of a day. Salivary assessments have become a preferred choice for measuring the body's hormone levels as they provide the most accurate and relevant results.

Salivary assessments allow for the evaluation of the free or bio-available hormones found in the body. Blood or serum assessments provide more limited information about the body's total or blood-bound hormone content. The hormones contained and measurable in the blood represent what the body stores. ***Those found in the saliva represent what the body actually has available to use.***

Urine Collection

Traditionally used to measure proteins, glucose, nitrogen and white blood cells to verify the diagnosis of kidney disease, diabetes, infection and illegal drug use, ***the urine can provide a veritable universe of information about the diverse, metabolic processes happening inside the body.***

The urine contains a wide variety of waste products, toxins, and metabolites. By analyzing these waste products, it is possible to learn a great deal about what is going on inside the human body. It's a bit like rummaging through the trash that's been thrown out into the alley. Although it might be a bit of unpleasant work, it's probably the best way to find out exactly what's going on inside the house on a daily basis.

Did you know? Rock Star Triathlete Academy members and fans of BenGreenfieldFitness instantly receive a 5% discount and Rock Star treatment with any complete or personal profile from Bioletics.

Just click [here](#) and use code BENGPF