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The Think Muscle Newsletter publishes the latest news and research on exercise physiology, dietary supplements, performance enhancement, lifestyle management, health & nutrition, and bodybuilding & fitness. The newsletter is dedicated to providing accurate and unbiased scientifically based information.

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### Message from the Editor-in-Chief:

Bryan Haycock, MS  
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First off I need to give a heads up about subscriptions to the newsletter. Our list service provider has been “bouncing” (i.e. removing) a tremendous number of subscribers without their consent. These are NOT people who have asked to be removed. Keep in mind that we haven’t actually had any people who have asked to be removed yet but I have heard about this happening to other more common magazines. ;) So, if you haven’t been receiving the newsletter after signing up, please sign up again. We’ve got a lot of good stuff coming your way.

Speaking of good stuff, we’ve got a great issue this month. We’re reintroducing a column called Supplement Fact & Fiction. It is a column I began back when Mesomorphosis was online. I had wanted to begin a supplement review column for some time and now is as good a time as any. Expect some in depth discussion of the merits of all your favorite, and perhaps your least favorite, compounds.

We’ve also got an easy read about the 3 basic types of diets. A lot of people ask me which diet is best. I have to tell them that it all depends. To find out more tune in below!

It seemed like a good time for another HST Q&A. It appears that HST has now spread all over the net. It’s hard to find a message board that doesn’t have somebody talking about it. Let me give a heart felt thanks to all of you out there who have so generously taken time to answer questions about HST on the boards and shared your results and experiences with others. With the growing interest in Hypertrophy-Specific Training principles I am working hard to provide as much useful info on it as I can until the book is ready, but I still seem to fall behind. Hopefully this issue’s HST Q&A will fill in some gaps for those of you who are using it.

We’ve also got a fantastic article by Will Brink, who took a bunch of creatine products and tested them for purity. You will be shocked to read what he found out...but then again, maybe you won’t.

Finally, a hardy thanks to all of you who have been inquiring about this new line of supplements I have been working on. I am really excited about the opportunity to be able to produce a line of supplements based on research and not just industry fads. Look forward the first HSN products in the next couple of weeks. Nothing fancy, just effective.

A note to those of you who use Netscape, you may have noticed some problems with the page displaying properly. There are some incompatibility issues that we are working on fixing. Sorry for any inconvenience.

Until next time...

-bryan

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## Supplement Fact & Fiction

Bryan Haycock, MS  
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In the pursuit of wealth, many supplement companies make fraudulent claims about their products. Often these claims are based on misrepresented science, shoddy science, or no science at all. This column exists to offer the consumer of sport supplements some protection from fraudulent supplement claims as well as direction towards those supplements that really do offer some benefit. The information presented here will be based mainly on data collected in controlled experimental conditions, when it exists. Anecdotal evidence will be considered, but not relied upon to support the manufacturers claims.

### Supplements: Love'm or hate'm?

Welcome to Supplement Fact & Fiction. In the world of bodybuilding there are two camps, one which anxiously seeks out every "latest and greatest" supplement promised to deliver rapid gains, and another which points a belittling finger at both supplements and their consumers chanting, "A fool and his money are soon parted!" I feel there is something to say for each point of view.

The first group is comprised mainly of newcomers to the culture of bodybuilding. They aren't alone though, they are joined by other "sport" enthusiasts looking to improve their weekend game or get that six pack so proudly displayed on the cover of all those "men's ~~underwear~~" uh, I mean "health" magazines. This group of new comers and casual enthusiasts are most susceptible to fraudulent marketing claims about supplements. This is not due to a lack of judgment on their part. Its due to a lack of accurate information about the products they see on the shelves. The rest of this group is comprised of veteran bodybuilders who, for whatever reason, have chosen not to use more effective, yet illegal, drugs in their pursuit of mass. This subgroup tends to read a great deal of information in bodybuilding magazines. They read everything they can find on nutrition, training, supplements, and even steroids and other anabolic drugs. Unfortunately the publishers filter the information available to them in order to protect the financial interests of their advertisers.

The second, and decidedly pessimistic camp, consists largely of bodybuilders who have had real or vicarious experience using steroids. Let me use the term "bodybuilder" to refer to anybody looking to increase strength or muscle mass. Their prejudice stems from a couple of possible sources. Many of the veteran bodybuilders in this group remember a time when the scientific community refuted the true properties and effects of anabolic steroids. Time and time again doctors would proclaim, "Anabolic steroids do not enhance athletic performance". These same doctors would then go on to warn of the *life threatening* side effects of using anabolics for muscle growth or performance enhancement. Real world bodybuilders would read this and compare their claims to the reality they witnesses around them. There was a lot of acne and

bloated faces but nobody seemed to be falling down dead from an effective cycle of steroids. This discrepancy in what they observed compared to what the medical community was telling them lead to distrust not only of doctors but also of science.

The pessimism of this group could also stem from reading studies done with anabolics with questionable methodology. These studies would involve inappropriately low doses of anabolics and/or a poor diet, only to conclude that testosterone does not increase muscle mass. This would be proclaimed in the face of larger than life bodybuilders who put on significant lean mass on the same testosterone the doctors proclaimed did not work. Over time, bodybuilders began to distrust scientific studies in general, putting their trust only in the anecdotal evidence “posturing” before them the gym.

An important source for their cynicism may also stem from actual experience comparing the effectiveness of anabolics to over the counter supplements. While on steroids they would experience rapid, although at times fleeting, gains in both mass and strength. Then they would try using supplements promising to produce “drug-like” effects only to be disappointed by minimal gains compared to the gains they experienced while on drugs. Negating what true gains they may have experienced with supplements, they generalize that all supplements are over-hyped crap and none of them deliver on their promises. Who can blame them for such an attitude? I certainly don't. Despite this deeply entrenched skepticism about the ability of supplements to promote gains in mass and strength, the supplement industry has continued to experienced tremendous growth over the last ten years. This indicates that despite the skepticism held by many, there are still a significant number of people purchasing supplements despite lacking any “drug-like” effects.

## **A voice of Reason**

Supplement Fact & Fiction was created to help anyone remotely interested in sport supplements. I'm sure all of you have experienced the feeling of being “suckered in” as you realize that the *article* you thought you were reading was actually a 3 page *advertisement* for the publisher's proprietary product line. Supplement Fact & Fiction is and will remain unbiased.

In Supplement Fact & Fiction you will only read about ingredients, not manufactures. The information provided will focus on scientific evidence as to the effectiveness or worthlessness of the particular ingredient. It would be nice to be able to take various manufacturers products to an independent lab for testing but that just isn't feasible right now. This may happen in the future but for now you will have to trust that what the manufacturer says about ingredients on the label is true.

## **About Research**

Studies can be evaluated by their design. Factors that may effect the validity of a study include sample size, exclusion criteria, treatment variables, whether the study is double blind or not, as well as dosages, length of study, individual characteristics of the subjects and even who funded the study. I will draw your attention to these issues when they pose a threat to the validity of the results or conclusions drawn by the researchers.

An issue that is frequently brought up is how the study was funded. It is important to realize that much of the research published involving sport supplements is supported by grants from the manufacturers of those supplements. This introduces bias into the study. Unfortunately, the National Institute of Health (NIH) is seldom interested in food supplements that may benefit athletes. They are most interested in diseases and drugs that are currently in vogue to research. I won't get into that right now, just understand that money for research on food supplements is hard to come by leaving the private sector (supplement companies) as the only source for funding. I don't mean to insinuate that all studies funded by supplement companies are biased or the results automatically cannot be trusted. Many times there are companies that are truly interested in the effectiveness of potential products. The same goes for drug companies who in large part fund all or part of the research done on new drugs they are interested in marketing to the public. Whenever possible I will be sure to point out who funded the study.

So what if there is no research testing the effectiveness of a supplement being marketed to you? Well, we'll tell you so. But there is still usually something to talk about. Sometimes in bodybuilding we are forced to refer to research that has nothing to do with the intended use of a compound we are interested in. For example, Tribulus Terrestris was generally investigated to see its effects on fertility in male animals like rams. Although fertility does not offer any direct benefit to somebody looking to increase muscle mass, the manner in which Tribulus effects fertility may also affect anabolism. Properties of compounds that are most beneficial to the general population will always be studied before properties that are of special benefit only to athletes. When this is the case, we will look at the effects seen in those seemingly unrelated studies and extrapolate what might happen in a bodybuilder. In a perfect world all substances that we are interested in will have been thoroughly tested on humans in situations that mimic real life including resistance exercise and appropriate nutrition. In the *real* world well done studies involving athletes and supplements are far and few between. Without always being able to refer to appropriate studies, some theorizing and even speculation will be done on occasion.

## **Who should read Supplement Fact & Fiction**

Supplement Fact & Fiction is written for both optimists and pessimists. It is for those of you who regularly buy supplements as well as for those who consider even protein powders as waste of money. The information presented will put in perspective the hype surrounding various supplements and perhaps raise interest in compounds that have not been considered or even forgotten. I hope to provide insight into the mechanisms by which various compounds are supposed to act thereby empowering the user to plan the most effective dosages and dosing schedules. Even those bodybuilders using pharmaceuticals may find potential benefit from various compounds that offer support to the body under the demands of rapid protein synthesis and growth. Ultimately what the reader decides to do with the information is up to them. Still, it is my hope that as readers become more educated manufacturers will be forced to work harder to bring truly effective supplements to market.

*As readers, feel free to send in requests that a certain supplement be evaluated. If I see enough interest in a supplement that I have not specifically addressed I will address it in upcoming installments of Supplement Fact & Fiction. If a supplement that you request contains active ingredients that I have already covered, I will not go over it again just because it is in a different formulation or marketed by a specific company. Requested supplements must contain new compounds not previously available or contain compounds that I have not covered in the column.*

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## **A Review of the Different Types of Popular Diets**

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At times it can be confusing to pick a diet. There are many different diets being marketed at any given time. How is a person to know how they differ and which one is right for them? Categorizing the diets into groups that share basic characteristics is a good way to start understanding popular diets.

### **Low carbohydrate diets**

Low carbohydrate diets are among the most popular diets around. Despite this popularity, most people don't really understand how the diet works. Here's the low-down on low-carb diets.

#### **A carbohydrate is a sugar is a carbohydrate**

Before getting too far into low carbohydrate diets, it is important to understand that, to the body, there is little difference between different carbohydrate foods. Bread or candy, it makes no difference. The only difference with reference to its carbohydrate content is the amount of time it takes to digest. Those that take a long time to digest are referred to as complex carbohydrate because they are long chains of sugar. Simple carbohydrates take no time at all to digest and are called simple because they are very short chains of sugar. Before any carbohydrate gets into the body, it is broken down into short chains. So to the body, carbohydrate and "sugar" are identical. It is only the tongue that can distinguish between the two.

#### **A tale of two fuels**

The body relies on 2 things for fuel, sugar (remember this is just another name for carbohydrate) and fat. There is a priority as to which fuel the body will burn first when both are available. Carbohydrate will generally be burned before fat. So when you eat a meal containing both sugar and fat the body will burn the sugar and store the fat. The fat will stay where it is stored until sugar is no longer available. Unfortunately, when sugar is no longer available, the brain triggers hunger so that you will eat more sugar, leaving the fat right where it is. "A moment on the lips, forever on the hips" as they say.

Most of the sugar you eat in your diet is reserved for the brain and nervous system. Some have interpreted this as meaning that carbohydrate is the body's "preferred" fuel. If this were so, wouldn't the body store carbohydrate instead of fat? Rather than carbohydrate being the "preferred" fuel, carbohydrate is the body's most "convenient" fuel under normal circumstances. This is why getting the body to use stored body fat instead of carbohydrate can be difficult.

Because the body will burn carbohydrate before it will burn fat, if you continually supply carbohydrate, the body will never dip into stored fat. There would be no reason to. The idea behind a low carb diet is to continue to feed the body essential protein, but eliminate, or greatly reduce the amount of carbohydrate, so that the body must use stored body fat for fuel. The liver then makes the necessary sugar for the brain, while the muscles switch to using fat.

**Nay Sayers have a point...sort of.**

Mobilizing stored fat when sugar intake is low is a natural function of the body. Even when sugar made in the liver runs low (such as during exercise), the brain can switch over to burning "ketones". Ketones are made from fat, of which there is an abundant supply already in the body. This is why low carb diets are often referred to as "ketogenic diets".

Opponents of low carb diets voice concern over the body's production of ketones. They feel this will cause a condition caused by poorly managed type-I diabetes called keto-acidosis. In the diabetic patient, insulin cannot be produced; this causes ketone production to rise far above normal, and can lower the pH of the blood. This has not been shown to happen in people without type-I diabetes. Without the ability to produce insulin, ketone levels can rise far above what naturally occurs when normal people consume less carbohydrate.

**In a nutshell**

Here are a few summary points to take home:

- The body burns either sugar (A.K.A. carbohydrate) or fat for fuel.
- If sugar is available the body won't burn fat. It is better to burn the sugar when available because it can't be stored.
- You must limit the availability of sugar to get the body to dip into stored fat for fuel.

A low carb diet may not be for everybody, especially those who don't like meat. But if you have tried other diets and are looking for a new diet to try, the low carb approach just might be the ticket.

**40/30/30 and Zone diets**



The term “zone” refers to optimizing the body’s metabolism through a diet containing a certain ratio of protein, carbohydrates (carbs) and fat. To Barry Sears, who coined the term “zone” with respect to diet, this zone can be achieved through a special diet which controls the body’s production of a hormone called insulin.

### **Much ado about Insulin**

Insulin is a very important hormone. It is what allows our cells to take up carbohydrates that we eat. Without insulin we develop diabetes. Diabetes is the condition when there is no insulin (type I) or when the tissues become insensitive to it (type II). As a result blood sugar rises and begins to cause secondary problems, which can be fatal over time.

Insulin is also able to affect the levels of other important chemicals in the body called eicosanoids. Eicosanoids are involved in everything from blood pressure to inflammation. There are few if any tissue in the body that are not responsive to eicosanoids.

Some eicosonoids are bad (increase pain, inflammation, raise blood pressure) and some are good (don’t increase pain, don’t promote inflammation, lower blood pressure). Aspirin for example and other non-steroidal anti-inflammatory drugs work by blocking the production of eicosonoids (NSAIDs) and thereby can reduce pain and inflammation.

Insulin promotes the production of bad eicosanoids. According to Barry Sears, you can lower the production of bad eicosonoids and increase the production of good eicosanoids by following a 40/30/30 eating plan. This means 40% calories from carbohydrate, 30% calories from protein, and 30% calories from fat.

As with the very low-carb diets, lowering insulin also greatly facilitates fat loss. Because carbohydrate intake is relatively low, and always eaten with protein and fat, blood sugar levels do not rise quickly. When blood sugar levels do not rise quickly, insulin stays fairly low and steady. This can increase the ability of a meal to provide a sustained sense of energy and curb hunger. The lower insulin also decreases the tendency of energy to be taken up by fat cells.

### **Fat ain’t all bad**

Finally, the zone diet places great emphasis on eating “good fats”. Just as some amino acids from protein are essential to life, so are some fats. Fats are important for cell structure, hormone production as well as for energy storage. Certain essential fats called “omega-3” fatty acids have many healthful properties. Diets high in omega-3s have been shown to reduce the risk of cardiovascular disease, diabetes, high blood pressure, and stroke. That’s one fancy fat!

In summary, a diet containing 40% carbs, 30% protein, and 30% fat may have health benefits beyond simple weight reduction, especially if essential fats are included. Plus, with a diet relatively generous in both carbs and fat, fixing appropriate meals is a snap!

## **Low fat diets**

There is probably no diet more common than a “low fat” diet. As dieters embraced it, an entirely new faction of the food industry was invented and has thus far thrived. All our favorite processed foods were soon further processed into “reduced fat” or “fat free” versions. So why all the fuss about fat? It can’t be all *that* bad...can it?

### **The cheering section**

The pressure to reduce fat intake came from two camps, first the dieticians focused on fat because it is the most calorie dense foodstuff. Second came the heart doctors who realized that certain kinds of fat in the diet were highly associated with the risk of developing cardiovascular disease. The two groups together present a very influential argument for Americans to reduce the fat in their diets.

### **The logic of Low-Fat eating**

When trying to lose weight, you must burn more energy than you eat. Burning more energy is easy, just get up and get going. Eating less energy is the hard part. The easiest way to eat less energy is to focus on reducing the foods that have the most energy in them, namely fatty foods.

Fat has 9 calories per gram. Protein and carbohydrate have only 4 calories per gram. Fat is also devoid of fiber making it even easier to eat a lot of it. On the positive side, because fat is so calorie dense (meaning you can fit a lot of fat into a small package) you can cut out a lot of fat without cutting out a lot of food.

### **Don’t throw out the baby with the bath water**

Not all fats are created equally. I think you will be happy to learn that fats have gotten a bad reputation because of the consequences of eating too many “saturated” fats. Not all fats are saturated and not all fats pose the health problems that saturated fats do.

Fats serve a broader purpose than simply providing texture, taste and calories to your diet. Just as some amino acids are essential to life, so are some fats. Fats are important for cell structure, hormone production as well as for energy storage. There are many problems experienced during states of malnutrition due to the lack of essential fats.

The association between saturated fat intake and cardiovascular disease is well known. Much of this association centers on cholesterol. Saturated fat raises blood cholesterol and LDL levels more than any other element in the diet. Studies have shown that increased saturated fat intake increases LDL (bad cholesterol) and lowers HDL (good cholesterol). (1) Cholesterol and fat, circulating in the blood, build up on the walls of the arteries. The buildup narrows the arteries and can slow or block the flow of blood. When the level of cholesterol in the blood is high, there is a greater chance that it will be deposited onto the artery walls. Over time this can lead to a narrowing of the arteries and an increased risk of heart attack.

A good high-carb/low-fat diet is one with a wide variety of fresh fruits, vegetables, whole grains, and low fat meats such as chicken, fish and lean cuts of beef. Stick to it and you

will not only see the pounds come off but you will also decrease your risk of heart disease.

## **In Summary**

You can fit virtually any diet into these three categories. You might find some variation as companies try to make their diet “appear” to be completely new, but in general they will still fit into the above categories.

I hope you noticed that I didn't place any one diet above another. The reason I did this is because each type of diet, when combined with weights, cardio and adhered to consistently, will yield lead to significant weight loss. So the diet you chose really just depends on your preferences.

References:

1: Loktionov A, Scollen S, McKeown N, Bingham SA. Gene-nutrient interactions: dietary behavior associated with high coronary heart disease risk particularly affects serum LDL cholesterol in apolipoprotein E epsilon4-carrying free-living individuals. Br J Nutr. 2000 Dec;84(6):885-890.

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## **Hypertrophy-Specific Training Q&A**

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### **Rep Cadence (tempo) and HST**

**Q:** Hi,

I am going to be starting my first cycle of HST and am wondering if there is a rep cadence [tempo] that works best with HST?

**A:** Actually there is. Basically, during the 15's the reps should start out slow and then speed up as you feel the burn begin to kill your strength. After all, the whole point is to flush the muscle with lactic acid.

During the 10's you should go slower when the weight is light. That way it will still be difficult to complete the set. As the weight gets heavier simply increase the tempo to ensure that you complete the set. BE careful not to get too sloppy though. It will do little good to use momentum to move the weight during the 10s.

The first week of 5's should be slow on the way down but still pretty explosive on the way up. Then as the weight nears your 5 rep max you will have no real control over how fast you move the weight. It will generally go slow simply because it is so heavy.

During negatives you should lower the weight in about 2 - 2.5 seconds. This may seem too quick to most traditionalists. Research has shown that if you go too slow during negatives you don't get the same growth stimulus. It begins to resemble the effect of isometrics if you go too slow. This is one reason why the old principle of "time under tension" isn't so simple as just time. The action of the muscle while under load is very important when trying to produce a specific effect.

### **How does microtrauma actually happen?**

**Q:** Bryan, you say that one of the main principles of HST is "strain-induced" muscle cell damage. Doesn't strain come from stretching something beyond its normal limits? How could muscle cells be "strained" when they never are really stretched. Doesn't a muscle contraction actually shorten a muscle fiber? It doesn't make sense.

**A:** You are right when you say that the range of motion of a joint will not allow most muscles to passively stretch far enough to cause stretch/strain microtrauma on muscle cells. However, an actively contracting muscle creates a different environment

Sarcomeres (area of a muscle fiber measured from Z line to Z-line) are hooked together in series at their Z lines. Each individual sarcomere "fatigues" at different rates when they are contracting. When one sarcomere fatigues the others continue to contract (or even go into rigor) and pull on it from each end leading to strain induced disruptions in the phospholipid membrane. These disruptions are actually important because IGF-1 and other growth factors, acting in a paracrine manner, travel to adjacent cells and help with repair, satellite cell activation, and hypertrophy. So growth factors actually ooze out from the cell when the sarcolemma gets disrupted (microtrauma).

You could also think of it this way. Get 3 rubber bands, 2 strong ones and 1 weak one. Hook them together with the weak one in the middle, then pull from each end to simulate contraction under load. All the rubber bands will stretch, but the weak one will stretch the most.

Now, this is where Time under Tension comes into play. Once again, think of the rubber bands as sarcomeres. Let's say the weak rubber band starts out strong but "fails" or begins to over-stretch early, even though at first it appears to be just as strong as the other two. Let's also say that the rubber bands have to stretch a certain distance before the signal for hypertrophy is achieved.

If you quickly pull on the rubber bands with high force, all the bands will stretch sufficiently to achieve the signal for hypertrophy. Of course if you maintain this high force the rubber bands will first fail (fatigue), then stretch (strain) then break (become necrotic and be replaced with fibrous tissue). So if you are going to use high force you have to control the time under tension or you will cause too much damage.

On the other hand, let's say you pull on all the rubber bands with less force. With less force none of the rubber bands will reach a stretch required for hypertrophy at first. However, as you hold the stretch, the weak one begins to fail (fatigue) and then it starts to get stretched as the other stronger rubber bands pull back to their original length. The weak rubber band then achieves the necessary stretch (strain) for hypertrophy but the others don't. This is why people have noticed that a certain amount of time under load is required for growth.

So with high loads more fibers reach the required stretch/strain to induce growth in less time. With lighter loads it takes more time under load but it will eventually lead to growth. The absolute size achieved will depend on the absolute load the fibers are exposed to so reach high loads will eventually become necessary to achieve significant hypertrophy.

### **Best way to eat for HST**

**Q:** How am I supposed to eat when using HST? I've read a lot about diets but I was just wondering if you had any advice.

**A:** This is a very good question. In reality, nutrition should be optimized for the desired goal, then left alone regardless of the training regimen.

HST principles optimize the training stimulus. Now, if you go on a fat loss diet and eat too few calories, HST will prevent as much muscle loss as possible because it is optimized for muscle growth. If you are trying to gain weight, HST is still optimized for muscle growth, so HST will ensure the greatest possible gains with a mass building diet.

Here is the only thing I would recommend as far as adjusting the diet. The purpose of the 15's and early 10's is to flush the tissue with lactic acid and create and accumulation of oxidative by products in the cells. In order to optimize this you must be eating a fair amount of carbs. When you eat a lot of carbs the muscle will burn a lot of glycogen, creating lactic acid and producing the desired effect (enhanced tendon strength and functional oxidative capacity).

When you get into the heavy 5's and negatives the carbs should come down a bit. Insulin sensitivity declines as muscle damage increases. I would say about 30% carbs during the really heavy weeks is sufficient to support growth.

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## What's Really in Your Supplements? An Update on Creatine

by [Will Brink](#) © 1999 BCG  
Author of Diet Supplements Revealed

Please send us your [feedback](#) on this article.

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### Introduction

As some well informed readers might recall, I wrote an expose on the various impurities and contaminants found in certain creatines on the market almost a year ago. The article was called "[What's really in your creatine?](#)". The article took a close look at the large variations in the quality of different creatines and killed the long standing myth that "creatine is creatine." I expected the article to have an effect on the creatine market both from a wholesale and a retail perspective, and it did. As I predicted in that article, It also got me into hot water with many companies and individuals who sell less than pure high quality creatine. My exact words were "What I am about to tell you is not going to make me a very popular person with many supplement manufacturers. In fact, some of them are going to be down right pissed off at me." I recall the drunk owner of one well known supplement company coming up to me at an after hours party at a convention and slurring "Hey Brink, you cost me a lot of money with that article of yours" to which I responded "serves you right for selling low grade creatine!" I knew where he got his creatine and it was junk. The article examined several key impurities often found in low grade creatines such as [Dicyandiamide](#), [Creatinine](#), [Dihydrotriazine](#), and [Sodium](#). From the tests that were conducted on a dozen or so brands of creatine using high-performance liquid chromatography (HPLC), it appeared the creatine made by a large pharmaceutical company out of Germany was far and away superior to creatine manufactured elsewhere, particularly China where the above chemicals could be found at very high levels.

For what ever reason, I have gotten the unenviable reputation as some sort of defender of the of the sports supplement consumer. A few months ago I came into the possession of a whole new batch of tests on creatine, various liquid creatines, and pyruvate products, from the same lab that did the original tests on creatine. The results came to me through the back door so to speak but the company who did the tests is a multi billion dollar pharmaceutical company and one of the largest producers of chemical intermediates (including the chemicals used to make creatine) in the world.

They know their stuff when it comes to testing for chemical impurities, not that it takes a multi billion dollar pharmaceutical company to do such tests anyway. I sat on the test info for a few months seriously considering whether I really wanted to write another such article and deal with the next drunk guy at some convention who gets mad at me because I exposed the fact that he sold low grade creatine. Hey, it's not my fault what people do to save a few bucks rather than shoot for the good stuff like an honest business person should. I know the words "sports nutrition" and "honesty" seem like an oxymoron, but there are a few good people and good companies out there, not to mention the fact that a quality creatine really is one of the best supplements going and is perfectly safe as many

studies have shown. In the end, I decided I could not sit on this information and live with myself. So, I dug through the giant pile of papers on my desk, blew the dust off the test results, and sat down to write another article on the current state of some of the creatine supplements we stick in our mouth. You ain't gonna like what you read unfortunately.

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### The Current State of Creatine

In some ways, the current state of creatine is pretty much the same as it was last year. A few -though growing number- of companies willing to sell the more expensive and purer creatine and the rest selling creatines that range from OK to really bad! In some respects, at least from these tests, it appears that several of the US manufacturers have improved while the Chinese manufacturers have gotten worse! The [accompanying chart](#) is a whole new batch of tests from that of last years tests and shows some creatines are loaded with impurities, in some cases up to 34,000 parts per million (ppm) of a single impurity which is almost 3.5% of the product! Now remember, people don't take say 200 milligrams of creatine, they take 5,000 or even 10,000 milligrams (5-10 grams) of creatine at a time. So, if the product has as much as 3.4% of an impurity, that's 340mg of the impurity per 10 gram serving. During the loading faze the number would be even higher! It's just a good thing that these chemical impurities don't appear to be toxic though one of them (dihydrotriazine) has no toxicity data and therefore should always be found in the non-detectable (n.d.) range in my opinion. A high quality creatine will contain 50ppm or less of dicyandiamide, 100ppm or less of creatinine, 100ppm or less of sodium, and non-detectable (n.d.) amounts of dihydrotriazine. The "good stuff " easily meets these standards and the rest often fall well short as the chart clearly shows. Now of course there are always going to be some batch to batch variations in the above numbers for any manufacturer, but those figures would be the average for any good creatine.

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### HPLC Creatine Test Results

		Creatinine	Dicyandiamide	Dihydrotriazine	Sodium
1	German Manufacturer	< 50 ppm	< 20 ppm	n.d.	trace
2	US Manufacturer #1	190ppm	400ppm	410ppm	750ppm
3	US Manufacturer #2	300ppm	100ppm	40ppm	no data
4	US Manufacturer #3	2500ppm	300ppm	90ppm	no data
5	Chinese Manufacturer #1	1500ppm	2300ppm	n.d.	no data
6	Chinese Manufacturer #2	100ppm	18000ppm	n.d.	no data
7	US Distributor #1	50ppm	20ppm	n.d.	trace
8	US Distributor #2	520ppm	40ppm	24ppm	280ppm
9	US Distributor #3	220ppm	120ppm	60 ppm	1250ppm
10	US Distributor #4	3000ppm	2000ppm	16ppm	220ppm
11	US Distributor #5	320ppm	60ppm	60ppm	no data
12	US Distributor #6	50ppm	34000ppm!	72ppm	530ppm
13	US Distributor #7	70ppm	30ppm	300ppm	no data
14	US Distributor #8	210ppm	80ppm	160ppm	no data

15	US Distributor #9	50ppm	20ppm	n.d.	trace
16	US Distributor #10	180ppm	80ppm	176ppm	360ppm
17	US Distributor #11	1480ppm	80ppm	30ppm	no data
18	US Distributor #12	50ppm	20ppm	n.d.	no data
19	GB Distributor #1	60ppm	1500ppm	n.d.	no data
20	GB Distributor #2	50ppm	20ppm	n.d.	trace
21	GB Distributor #3	80ppm	20ppm	n.d.	no data
22	Spanish Distributor	200ppm	30ppm	n.d.	no data
23	Canadian Distributor	50ppm	20ppm	n.d.	trace

n.d. = non-detectable

HPLC = high-performance liquid chromatography

### The State of Liquid Creatines and Gels

Where do I begin with the liquid creatine issue? As you can see from the testing chart done on liquid creatine and gels, it was not a very large sample size. However, the tests were done on the better known brands of liquid creatine and gels. What if a larger sample size of liquid and gel products had been tested? I would expect to see pretty much the same results. Why? Well, even though every company selling liquid creatines and gels wants you to believe they are the one company who has discovered the magic chemical formula for keeping creatine stable in any type of liquid/gel, there is no reason at this time to believe it's true. What I do know is some of the top R&D scientists in the world have told me repeatedly that creatine will not and does not stay stable over months or years in a liquid or a gel period. I was told point blank by one of the largest creatine manufacturers in the world that they had been asked by one of the largest sports drink manufacturers in the world to design a liquid sports drink with creatine in it. They were unable to find a way to make the creatine stable in liquid no matter what they tried and lost millions in potential sales by being unable to produce the product. I suppose it's possible that some small company or entrepreneur has discovered a stabilization process that eluded one of the top laboratories in the world that works with creatine, but I highly doubt it. Now, I actually have to back up somewhat from those harsh statements about liquid creatines and gels. I was recently contacted by a scientist from a company who said they are 90% sure they will have truly stabilized liquid creatine to be launched in the near future but none of them felt anything currently on the market was stable. Our small test results would seem to agree with that assessment, but anything is possible right? As the reader can see, one gel was as low as 11.2% creatine with lots of creatinine and the liquid was only 14.4% creatine. I leave it to the reader to make up their own mind regarding such products.

### HPLC Creatine Test Results (Gels and Liquids)

		%Creatine	Creatinine	Dicyandiamide	Dihydrotriazine	Sodium
1	Gel #1	14.4	5000 ppm	120 ppm	n.d.	840 ppm
2	Gel #2	11.2	7000 ppm	54 ppm	n.d.	no data
3	Liquid	16.8	5000 ppm	570 ppm	860 ppm	no data



n.d. = non-detectable

HPLC = high-performance liquid chromatography

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## **Conclusion**

So what can the reader do with this information? As I stated in the first article: "As for the consumer, if it were me, I would demand the HPLC test results from whom ever I was buying my creatine from regarding the chemicals listed in this article." The same still holds true today and the tests should of course be done by an independent lab. Most companies when asked for test results on creatine will send you a simple purity test. A purity test will tell you little to nothing. The purity level of all the creatine products were also tested and they generally fell between 88 and 92%. Now before you go off yelling "but my creatine says 99% pure creatine monohydrate on the bottle," you have to remember there is a small amount of water in creatine monohydrate which leaves plenty of space to hide impurities. So, if these impurities concern you, you should ask for the HPLC tests on those specific impurities. If you don't care about it hey, that's your business. So, more today than ever, the old expression "creatine is creatine" fails to hold water. However, a high quality creatine product it still the hottest thing going in bodybuilding/sports supplements. It increases strength, lean body mass, and, to a lesser extent, endurance, so a high quality brand of creatine is still a safe and effective supplement.

The astute reader will recall, I also mentioned I had the testing results for many pyruvate products in the beginning of the article. If you think some of the creatines are bad, wait until you see what's in your pyruvate products! That's for another article. Keep an eye out for it!

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## **A brief description of the impurities found in low grade creatines**

**Dicyandiamide (DC):** DC is actually a derivative of one of the starting chemicals (cyanamide) used in creatine production. DC is formed during the production of creatine products, and large amounts found in a product are considered the result of an incomplete or inefficient process. A quality creatine product will contain very small amounts, less than 20-50ppm. DC does not appear to be a particularly toxic chemical. Oral studies with animals (rats and dogs) lasting up to 90 days have not shown serious toxicity or carcinogenic effects, and acute poisoning also takes very high amounts (LD50 /oral / rats = <5000mg/kg). DC appears to have many uses in the chemical industry. Some of the more interesting is the use of DC in the production of fertilizers, explosives, fire proofing compounds, cleaning compounds, soldering compounds, stabilizer in detergents, modifier for starch products, and a catalyst for epoxy resins (AllChem Industries data sheet. AllChem Industries inc., Gainesville FL, 32607.). At the concentrations found in some of the creatine products (see below), it's a good thing this stuff does not appear to be particularly toxic. However, as far as I am concerned, I don't want to be eating the stuff.

**Creatinine:** Creatinine is one of the easy compounds to discuss on this list. Creatinine is actually a natural byproduct of creatine metabolism in the human body and of creatine production. A small amount can be found in every creatine product. However, in some products large amounts can be found (see chart). It is probably safe to say that the

ingestion of creatinine is a safe endeavor. There is some research that links the ingestion of creatinine from meats with increased colon cancer incidence, but in all honesty I would not put much stock in that or get all worked up about it. The point is, when I buy creatine I want to eat creatine, not creatinine. Though a natural byproduct of creatine metabolism, it does not have any ergogenic effects and therefore I don't want large amounts of it in my creatine, period. A high quality creatine product should contain less than 100ppm of creatinine in my opinion.

**Sodium:** Like the aforementioned creatinine, sodium is an easy one to talk about. Also, like creatinine, it is a generally safe thing to ingest at normal intakes. At the levels found in these creatine products, the amount of sodium added to the diet is very small and should pose no problems, even to the most sodium phobic person. However, like I said before, when I pay for creatine I want creatine, not sodium.

**Dihydrotriazine (DT):** DT appears to be the real mystery chemical as far as potentially toxic contaminants found in some creatine products. One company had it listed as "...Dihydrotriazine is often found in various creatine products. This substance is a byproduct of non-optimized creatine productions and consequently widely spread over creatine products.

Dihydrotriazine is a compound with unknown pharmaceutical and toxicological properties." It was virtually impossible to find any useful safety data on this chemical. However, DT is part of a large family of chemicals known as the "triazines." It is an organic base with many derivatives. Some of these derivatives are toxic while others are known to be non-toxic, so it is very difficult to come to any real solid opinion regarding the potential toxicity of this chemical. One chemist I spoke to from a major pharmaceutical supply company said to me on the phone "it's safe to say that there will be major differences in toxicity between derivatives since 'triazine' simply means possessing three C=N-H groups. Some derivatives are highly toxic." Bill Roberts, a regular contributor to Mesomorphosis and former writer for Dan Duchaine's Dirty Dieting newsletter commented after I sent him over this information: "There really is no way to say just how high a chronic intake of this chemical [these chemicals] is safe in humans from the information given. If the amounts were very small, say a few milligrams per week, it's a reasonable guess that there would probably be no problem. But if a creatine brand has say 1% of this impurity [these impurities] then people are going to be consuming thousands of milligrams of this compound [these compounds] over time. I think we have to be concerned about taking so much of something that really isn't well studied in humans for safety. It would certainly be unwise to assume that toxicity is not an issue. If the consumer has a choice between a creatine brand that contains this impurity [these impurities] in significant amounts, and one that is more pure, I'd certainly recommend spending the extra money and obtaining the purer product."

So as you can see, we are left with a major question mark regarding DT. For me, the less I know about a chemical the less of it I want to find in any product I am ingesting. Though this chemical might turn out to be perfectly harmless, I think it should not be found in any amount and thus should be non-detectable (n.d.) in the ppm range until we

know more about this chemical. As you can see from [the tests](#), some companies have n.d. amounts while others have far more than that. I find this unacceptable, and so should you.

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## **Team Think Muscle**

### **Be on the Cutting Edge!**

Spread the word about the Think Muscle Newsletter and send the latest information on health, fitness, nutrition, training, and supplementation to all your colleagues, friends, and family. Give all these people THE BEST and latest information to allow them to increase their knowledge base and develop their best body ever! By sharing this incredible information, you are giving the gift of health. ACT NOW! Anyone can subscribe to the FREE weekly newsletter online at <http://www.thinkmuscle.com/newsletter.htm>. You can also send us the name and email addresses of five of your friends and we will automatically send them an invitation to join and a copy of our most recent newsletter. Imagine people you refer getting this amazing and detailed information for FREE. They will definitely be indebted to you! If you refer five people to us, we will also enroll you for FREE into Team Think Muscle, which will give you some great benefits in the future -- more details to come!

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## **Reader Survey**

### ***Tell Us What You Think?***

#### *1. Message from the Editor-in-Chief:*

- It was good.
- It was okay.
- I didn't like it.
- I'm not interested.

#### *2. New Column! Supplement Fact & Fiction*

- It was good.
- It was okay.
- I didn't like it.
- I'm not interested.

#### *3. A Review of the Different Types of Popular Diets*

- It was good.
- It was okay.
- I didn't like it.

I'm not interested.

*4. Hypertrophy-Specific Training Q&A by Bryan Haycock*

It was good.

It was okay.

I didn't like it.

I'm not interested.

*5. What's in your Creatine? By Will Brink*

It was good.

It was okay.

I didn't like it.

I'm not interested.

*6. What type of articles would you like to see in the future? (Check all that apply.)*

Anabolic Steroids and Pharmaceuticals

Anti-aging medicine

Body Transformation

Children's Health and Nutrition

Competitive Bodybuilding

Diet and Nutrition Reviews

Dietary Supplements

Exercise Physiology

Fitness Competitions

Fitness Psychology

General Health Topics

Lifestyle Management

Men's Health

Powerlifting

Seniors Health Topics

Sports Specific Training

Women's Health and Nutrition

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We hope you have enjoyed the latest issue of the Think Muscle Newsletter. Suggestions? Comments? Questions? We'd love to hear them!

Best regards,

**The Think Muscle Editorial Staff**

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