

# Simple but Powerful Ways to Boost Athletic Performance

Analysis by [Dr. Joseph Mercola](#) ✓ Fact Checked

## STORY AT-A-GLANCE

- › When and what you eat, and how you hydrate, can make a big difference in your athletic performance, and can affect your payoff in terms of the amount of muscle you can build
- › Athletes need about 30 grams of protein four times a day. If you do a whole-body workout, you'll need about 40 grams of protein to maximize muscle protein synthesis
- › The choice of exercising in a fasted state or not depends on your goal. For a professional athlete, it makes sense to have some carbs and food in your system to optimize performance. For the average person, however, especially older people, optimizing autophagy is likely a far more important goal, so for them exercising while fasting may be a better choice
- › Dehydration acclimation will trigger beneficial adaptations such as expansion of baseline blood volume, which will improve your athletic performance over time
- › Athletic performance can also be improved by boosting your blood volume with acute salt and fluid loading, increasing your bicarbonate level to hit peak alkalosis, and by cooling your body before or during your workout

James DiNicolantonio, PharmD, (my coauthor for "[Superfuel](#)") and Siim Land have written three books together, "[The Immunity Fix](#)," "[The Mineral Fix](#)" and, now, "[WIN: Achieve Peak Athletic Performance, Optimize Recovery and Become a Champion](#)," which is the topic of today's discussion. "WIN" is a great reference, loaded with simple

but powerful exercise strategies. It's also one of the best books ever written on hydration.

I've often warned that unless you're engaging in regular exercise, especially after you hit 40 or 50, you're headed for an eventual metabolic and structural catastrophe. The only sure thing about your future is that you'll become frail, which is a miserable way to die. There's no magic pill for frailty.

To avoid frailty you simply must engage in regular movement and exercise. When and what you eat, and how you hydrate, can make a big difference in your performance though, and can affect your payoff in terms of the amount of muscle you can build.

## **Should You Eat Before Exercising?**

Many fitness experts believe that you should have carbs and protein before you work out, because you'll be able to work out stronger. However, I believe far greater benefits can be had by exercising in a fasted state, as this will allow you to maximize autophagy. Land addresses this in his brilliant book, "Metabolic Autophagy." DiNicolantonio says:

*"I think it's important to train both in a fasted state, as well as loading with complex carbs about an hour before vigorous exercise. The reason is because you want metabolic adaptations for both systems – utilizing fat for fuel in a fasted state, and also the ability to utilize glucose.*

*Essentially, if you're exercising in a fasted state, your body's going to be better at utilizing fat for fuel, and it's going to help spare glycogen, which is important for anaerobic performance. So, training in a fasted state ... will help more vigorous exercise performance [by] sparing of glycogen, because you're able to utilize the fat for fuel better, and you're probably going to burn fat better in a fasted state as well.*

*But the data is very clear that if you are performing at a vigorous pace, essentially 70% VO2 max or higher, preloading with about 50 grams of complex*

*carbs is absolutely going to help preserve muscle glycogen levels and improve performance, both from an endurance and a peak power output standpoint.”*

Land agrees, stating that the choice of exercising in a fasted state or not depends on your goal. If you're a professional athlete, he believes it makes more sense to have some carbs and food in your system, because it will optimize performance. And, if you're competing, you'll need to train at near-peak performance most if not all the time, so training in a fasted state may be counterproductive.

*“Of course, there is some merit to training periodically in a fasting state or a low-glycogen state, to build up this metabolic flexibility and adaptation. But from a progressive overload perspective, which means that you actually get better over time, you get stronger or faster, whatever the sport is, then you will need to have some calories to help you to push yourself further,”* Land says.

For the average person, however, especially older people, optimizing autophagy is likely a far more important health goal. Nothing depletes glycogen from your muscles more effectively than exercising in a fasting state, which will maximally upregulate autophagy. So, for many, it's a really powerful strategy. That said, it's not black-and-white. As noted by Land:

*“Always exercising in a fasting state can also lead to a muscle catabolism, and that can also be harmful for the elderly. So even for the elderly, it can be good to, periodically at least, have some calories in their system, especially amino acids, during the exercise to help to prevent this muscle catabolism.”*

## **Should You Take HMB?**

One of the things you want to achieve with your exercise is the activation of mTOR, and one way to do that is to make sure your body has plenty of branched-chain amino acids, especially leucine, isoleucine and valine. One of the metabolic byproducts of leucine is hydroxymethylbutyrate (HMB). Some fitness experts recommend taking HMB either before or after your workout.

According to DiNicolantonio, there's evidence that HMB is beneficial, particularly in catabolic states, but the jury's still out. Some studies show dramatic improvements in muscle gains when using HMB, but it's still fairly controversial. "Personally, I can't necessary recommend it outside of really low-caloric intake states to help preserve muscle mass," he says.

Land agrees, saying he believes HMB would be most appropriate for people with sarcopenia, or people who are on low-calorie or low-protein diets. "If you're getting enough protein in your diet, then you probably don't need it," he says.

## **How Proper Hydration Can Optimize Your Workout**

My favorite part of "WIN" is the section on hydration. There's far more to proper hydration and hydrating for fitness performance than meets the eye. Most will simply drink water or, worse, sports drinks chockfull of sugar in addition to the electrolytes, and call it done. But as explained by DiNicolantonio:

*"If you're a highly competitive athlete, training three months out before competition ... then you want to practice something called dehydration acclimation. Multiple sessions of mild dehydration will lead to adaptations where you will get expansion of baseline blood volume and all these other adaptations, where you're actually performing better later on.*

*Your training may suffer a little bit performing dehydration acclimation [but] you get those metabolic adaptations. Then, before competition, you do salt loading with high doses of salt and fluids about 90 minutes prior. That's going to dramatically boost blood volume and increase performance. But you don't always want to use high doses of salt, because you want adaptations to being in a dehydrated state.*

*So, there's really three ways to hydrate. If you don't feel like you have a lot of energy before a training camp, you want to take 1,000 to 2,000 milligrams of sodium [one-half to 1 full teaspoon of salt] and 10 to 20 ounces of fluid,*

*respectively, to get a blood volume expansion of about 3% to 4%, so that you can train fairly well.*

*The goal then is to actually lose about 1.5 to 2.5% of your body weight through sweat, which will induce mild dehydration. When you do that multiple times, you get dehydration acclimation ...*

*The top benefits are when you start hitting 3,000 to 4,300 milligrams of sodium, which is essentially 1.5 to 2 teaspoons of salt per liter of fluid. When you hit those higher amounts (consumed with 26 to 33.8 oz. of fluid, respectively), you can get 8% to 10% increases in blood volume and dramatic improvements in performance ...*

*If you want to acutely boost performance dramatically, you want an 8% to 10% increase in blood volume, because the blood volume drops within five minutes of vigorous exercise by 8% to 10% as blood flows away from the heart towards working skeletal muscle.*

*This relative drop of blood volume feeding the heart ... is really the main linchpin for decreasing athletic performance. So, if you ... take appropriate salt solutions prior to performance, you can prevent the drop in blood volume and dramatically improve performance.*

*When I say dramatically improve performance, there's nothing better. Nothing even comes close to preloading with salt and fluids. I'll give you an example. Beta-alanine can increase the time you can perform vigorous exercise by about one minute. However, taking salt solutions can increase exercise time by anywhere from typically 10 to over 20 minutes, so it's 10 to 20 times more effective than the best preworkout [supplement] on the market."*

## **The Importance of Carnosine**

That said, beta-alanine is also very important. It's the rate-limiting amino acid for the formation of carnosine, which slows the aging of cells and protects against

mitochondrial dysfunction.<sup>1</sup> It's especially important if you're prediabetic, which a majority of Americans are. Another way to boost your carnosine level is with magnesium orotate. Orotate (orotic acid, a mineral) converts into beta-alanine, and then into carnosine in your liver.

So, it basically acts like a delayed-release beta-alanine. There are also carnosine supplements available, but they're not as cost-effective. As noted by DiNicolantonio, taking a precursor is typically better than taking the actual substance that you're trying to increase.

## **Hydration Is More Than Merely Drinking Water**

A common misconception is that hydration is all about water intake. DiNicolantonio and Land turn that myth on its head in their book. Merely hydrating with plain water can actually have negative effects on performance, both vigorous exercise performance and endurance exercise. DiNicolantonio explains:

*"To give you an example, if you consume just 5 ounces of water in 15 minutes, that exceeds gastric emptying. And, when you're vigorous exercising, gastric emptying dramatically goes down. So, if you drink too much water, you're going to bloat the system.*

*Water is just going to sit in the stomach, and you can actually decrease vigorous exercise performance by 2.5% just drinking water, which is what most people think is going to help them.*

*So, that's the problem in vigorous exercise. In endurance exercise, drinking too much plain water dramatically increases hyponatremia or low sodium levels in the blood, which can kill you ... Drinking plain water has also been shown to increase the susceptibility of skeletal muscle to electrically-induced muscle cramps. So again, salt and electrolytes play key roles here at reducing muscle cramps, especially in performance in the heat ...*

*If you get the salt solution dosing correct, it can decrease your heart rate by nine to 10 beats per minute. It can increase exercise duration by 20 to 21 minutes, which is essentially anywhere from 25% to 50% increase in how long you can exercise vigorously, which is crazy when you think about it.*

*And, it can decrease core body temperature by three-quarters of a degree Fahrenheit, because we lose water from our blood volume to dissipate heat through sweat. And so, if you have more fluid, you can cool off better. You'll have better sweat rates, and that can evaporate and cool you down quicker. So, you can keep your core body temperature lower simply by drinking salt solutions before exercise."*

## **Hydration and Other Benefits of Glycine**

To do the hydration protocol reviewed above, you'd start drinking the salt solutions around 90 minutes before your exercise, finishing it off over the course of about 30 minutes. It's important to not include any kind of glucose in the solution, as glucose will increase diuresis and cause dehydration.

To your salt solution you could, however, add glycine, an amino acid with a mildly sweet taste. Glycine helps increase the absorption of sodium in the intestine and decrease core body temperature. Glycine is also an inhibitory neurotransmitter and may help reduce muscle cramps. Glycine is thought to be the reason for why pickle juice is so effective at rapidly aborting muscle cramps.

*"There's been two studies showing that pickle juice, at about 2.5 ounces, can abort a muscle cramp within 30 to 90 seconds," DiNicolantonio says. "It can't be due to volume expansion and interstitial fluid expansion. It would never happen that quick. It's the acetic acid in the pickle juice, we think, that releases glycine, and that basically aborts a muscle cramp."*

My favorite hydration strategy is to drink a quart of water about one hour before my workout and sauna, in which I have added two packets of our new electrolyte powder

and one-half teaspoon of glycine powder (about 3 grams).

## **Summary of the Dehydration Acclimation Protocol**

So, to summarize the dehydration acclimation protocol discussed above:

- 90 minutes before exercise, start drinking a solution of 0.5 to 1 teaspoon salt with 10 to 20 ounces of fluid to get a blood volume expansion of 3% to 4%, or 1.5 to 2 teaspoons of salt with 26 ounces to a full liter of fluid, respectively, for an 8% to 10% increase in blood volume for maximum improvement in performance.
- Optional: Add 4 or 6 grams of glycine to improve sodium absorption and decrease core body temperature.
- Next, your goal is to lose 1.5% to 2.5% of your body weight through sweat, which will induce mild dehydration.
- Rehydrate using a formula of one-half teaspoon of sodium per liter of fluid lost during your training.
- As you do that multiple times, you become acclimated to dehydration and get all the benefits of that – better baseline blood volume, better sweat rates, improved ability to cool off.

## **Raising Your Alkalinity Can Boost Performance**

There's a common misconception that delayed-onset muscle soreness is due to lactate or lactic acid. As explained by DiNicolantonio, lactate is actually the beneficial molecule that pulls the acid – hydrogen ions – out of your cells. Your body actually uses lactate as fuel during exercise.

However, lactate correlates with high acid in your cells, so there's this myth that lactate is bad for you, even though it's not. When you vigorously exercise, you produce loads of hydrogen ions because ATP demand exceeds supply. When that happens, you automatically retain acid.



You can get ahead of the problem by boosting your bicarbonate level to hit peak alkalosis. This will increase your pH, reducing the acidity in your blood, and this too can dramatically improve performance. The reason for this is because many mitochondrial enzymes are pH-sensitive. As the cell becomes more acidic, it shuts down those enzymes and reduces ATP production. Eventually, the muscle ceases to work.

*“A lot of people don't believe that you can make the body more alkaline,” DiNicolantonio says. “Well, it's clear you can, because you can boost bicarbonate levels using things like sodium bicarbonate or sodium citrate.”*

*A lot of people also don't believe that diet has anything to do with the acid/base balance in the body, but it does. Because, from a physiological perspective, the kidneys can only get rid of 40 to 70 milliequivalents of acid before it starts retaining 1 milliequivalent of acid for every 2.5 milliequivalents above that threshold. To get rid of that retained acid, you have to breathe it out, but to breathe out acid, you have to deplete one molecule of bicarbonate.*

*So yes, you can breathe out acid, but it's not a free lunch. You will deplete your bicarbonate levels. This is why you do need a balance if you're on an animal-based diet or a carnivore diet. You need to be consuming some type of bicarbonate-forming substance, whether it be sodium citrate or sodium bicarbonate, to offset the acid load of the diet.”*

I agree that this is likely a crucial point. If you're on a high-meat or carnivore diet, you need to address this because you can get far too acidic and it best to neutralize this excessive acidity with bicarbonate and/or citrate. I personally use both, as citrate has the added advantage of binding to oxalates in your foods.

## **Testing for and Correcting High Acidity**

The good news is you can easily measure the pH of your body fluids with a litmus test. According to DiNicolantonio, the best time to test is four hours after a meal. If your urine pH is less than 6.8, you're likely retaining acid. Ideally, you want to be around 7.4.

If you're too acidic, you can take either sodium citrate or sodium bicarbonate to lower it. DiNicolantonio's preference is sodium citrate, as it does not increase the pH of your stomach the way sodium bicarbonate does. He explains:

*"Essentially, when you are consuming bicarbonate, it's making the stomach pH increase and you're diluting the acid of your stomach. You need acid in order to digest food and absorb nutrients. It's super important. So, if you start messing with the pH of your stomach, that's not good because you might not be able to digest food well.*

*That's how we kill pathogens, too, so the risk of food-borne illness will go up as well. And chloride is important to form hydrochloric acid in the stomach acid. The reason why I like sodium citrate is because you're not dumping bicarbonate into the gut, and you're not decreasing the acidity of the stomach.*

*The key here though is that most studies have inappropriately dosed sodium citrate much too close to exercise to show benefits. It takes longer to form bicarbonate in the body when you take citrate versus taking bicarbonate. So, you actually should be dosing sodium citrate about four hours before performance to get to a peak alkalosis state.*

*What's great about citrate too is, if it doesn't get converted to bicarbonate, citrate is actually better than bicarbonate in regards to improving alkalinity. Because one molecule of citrate can bind three hydrogen ions, whereas it's a one-to-one binding of bicarbonate to hydrogen. So, citrate really is just an amazing way to alkalinize your body ...*

*But here's what's really important. You don't want to drink it in solution, because it's tough on the gut. It's really something you want to take with food, at least 20 to 25 grams of carbs. You take it four hours before performance, which is really when you should be having your protein meal. So, it's nice that you can dose the citrate with food, so you can tolerate it better ...*

*Five grams of sodium citrate inhibits 60 milliequivalents of acid. An average carnivore is going to produce 150 to 200 milliequivalents of acid. So, in order to neutralize that, you would need anywhere from 5 grams of sodium citrate, about three times a day.*

*You really want to be at a net acid excretion of zero, because even if your body is able to excrete acid, it's still damaging on the kidneys to do that, so you want to try to get it to a neutral acid excretion."*

## **The Importance of Getting Your Protein Dosage Right**

"WIN" also delves into the issue of protein, which is really important. In the past, I got overzealous about not activating mTOR and went on a low-protein diet (0.6 to 0.8 grams of protein per kilogram). It was a terrible mistake.

Once I realized it and doubled my protein intake to 1.5 grams per kg (140 to 150 grams) per day. This helped me put on over 25 pounds of muscle mass and I now weigh 200 pounds for the first time in my life and my body fat is around 10%. Land expounds on this important topic:

*"In animal studies, mTOR activation can be linked to accelerated aging and some cancers. But there's no human studies, and at least when it comes to exercise performance, mTOR is still quite central to things like muscle protein synthesis and muscle growth.*

*We also know that muscle use is very important for longevity and anti-aging, so I think the worries about [mTOR] can be a bit overblown. I mean, protein isn't the only thing that activates mTOR. It's also carbs and insulin, so you're screwed either way if you're wanting to restrict mTOR.*

*But there's a limit to how much mTOR you're going to activate in one sitting. Because the amount of protein synthesis is also limited, and that threshold is around 20 to 40 grams of protein in one sitting, you're not going to activate more muscle protein synthesis by consuming more protein. So, it doesn't matter*

*if you eat 100 grams of protein or 20 grams of protein in one sitting. You're still going to activate the same amount of mTOR ...*

*If you eat six times a day, then you're still going to turn on mTOR even if you eat very few calories. Even if you eat like 100 calories or 10 grams of protein. You're on a low-protein diet, you're eating 10 grams of protein, but you're eating six times a day then it's still spiking your mTOR several times, compared to eating two times a day or once a day.*

*But even if you are eating 200 grams of protein, for example, in one sitting, you're not going to activate more mTOR because it's going to be capped off. That's why athletes and bodybuilders are eating six times a day, to basically have their protein synthesis elevated frequently so that they will build more muscle and recover faster.*

*So, that's why the athlete would be eating more frequently whereas the average person [shouldn't]. And it doesn't matter how much protein they're eating. If you're eating in a confined eating window, then the eating frequency basically matters in terms of how much mTOR you're going to activate over the course of 24 hours, not the actual amount of protein in grams.”*

## **How Much Protein Do You Need for Muscle Building?**

So, just how much protein do you need? The recommended daily allowance (RDA) for protein is quite low, only 0.4 grams per pound of body weight.

But the research shows that, at least for elderly people, higher protein intake is better for maintaining muscle mass and bone density and reducing frailty. For the elderly, Land recommends 0.7 to 1.0 grams of protein per pound of body weight (double that amount for grams per kg). So, the RDA is considered inadequate even for regular people.

**“ For athletes, the evidence is pretty clear that you want about 30 grams of protein four times a day as a**

**minimum. If you do a whole-body workout, you actually want to increase that to about 40 grams of protein to maximize muscle protein synthesis. ~ James DiNicolantonio”**

When it comes to sports and fitness, protein demands increase exponentially as well. According to Land, the optimal peak seems to be around 1.6 grams per kilogram of body weight, or 0.8 to 1 grams per pound of body weight. You're not going to be building more muscle if you eat more protein than that. Higher amounts will help burn more fat though, or will result in less weight gain if you're in a calorie surplus. DiNicolantonio chimes in:

*“For athletes, the evidence is pretty clear that you want about 30 grams of protein four times a day as a minimum. If you do a whole-body workout, you actually want to increase that to about 40 grams of protein to maximize muscle protein synthesis. The data is pretty clear too, that taking 30 to 40 grams of casein, which is a long-acting protein, about 30 minutes before bedtime, will help maximize muscle protein synthesis.”*

## **How to Cool Down More Effectively**

Another important topic covered really well in “WIN” is how to lower your core body temperature. Most people make the mistake of simply cooling the back of their neck or their chest when they get hot.

But to rapidly and effectively lower your body temperature, you need to focus on your glabrous skin, which is enervated with special blood vessels that can dilate and bring in cold directly from the venous supply right into the arterial supply, bypassing the capillaries. Your glabrous skin is found on:

- The palms of your hands
- Your ears

- Your face, particularly the forehead and cheeks
- The bottoms of your feet

## **How Cooling Your Body Can Improve Performance**

DiNicolantonio explains:

*“Studies show that cooling the glabrous skin is twice as effective as cooling the chest or the back. In really hot situations, the glabrous skin can dump five times as much heat as compared to non-glabrous skin. The best way to cool those skin surfaces down is using water, because water conducts heat/cold two to four times better.*

*So simply putting your palms and the bottoms of your feet in cold water, you do that for 30 minutes and you're going to drop your body temperature. The goal for precooling the body is to drop core body temperature by 0.5 degrees Fahrenheit, which is about 0.3 degrees Celsius.*

*You see the dramatic improvements in performance because you have a larger tank to soak up all the heat before you hit a critical core body temperature [where you start to sweat and lose electrolytes] ...*

*If you're precooling the body, you want to avoid water temperatures of 59 Fahrenheit or less, because that can actually inhibit performance. Ideally, you want to be between that 64 and 84 degrees Fahrenheit, which is considered cool water.*

*You can start at 84 and slowly notch your way down. What the studies show is that if you're using 84 Fahrenheit water, it's probably going to take you an hour to drop half a degree Fahrenheit. But if you're using 64, it'll probably only take you 20 to 30 minutes, depending on how much surface area you're cooling.*

*You don't even have to do precooling. You can do this during training. It's been shown if you cool glabrous skin, like cooling both of the palms during the rest*

*periods, you can increase bench reps and pull-ups by 40-140%. So, you get really good benefits from cooling the body.”*

To learn more, be sure to pick up a copy of **“WIN: Achieve Peak Athletic Performance, Optimize Recovery and Become a Champion.”**

## Sources and Reference

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- <sup>1</sup> [Chemistry Central Journal volume 7, Article number: 38 \(2013\)](#)