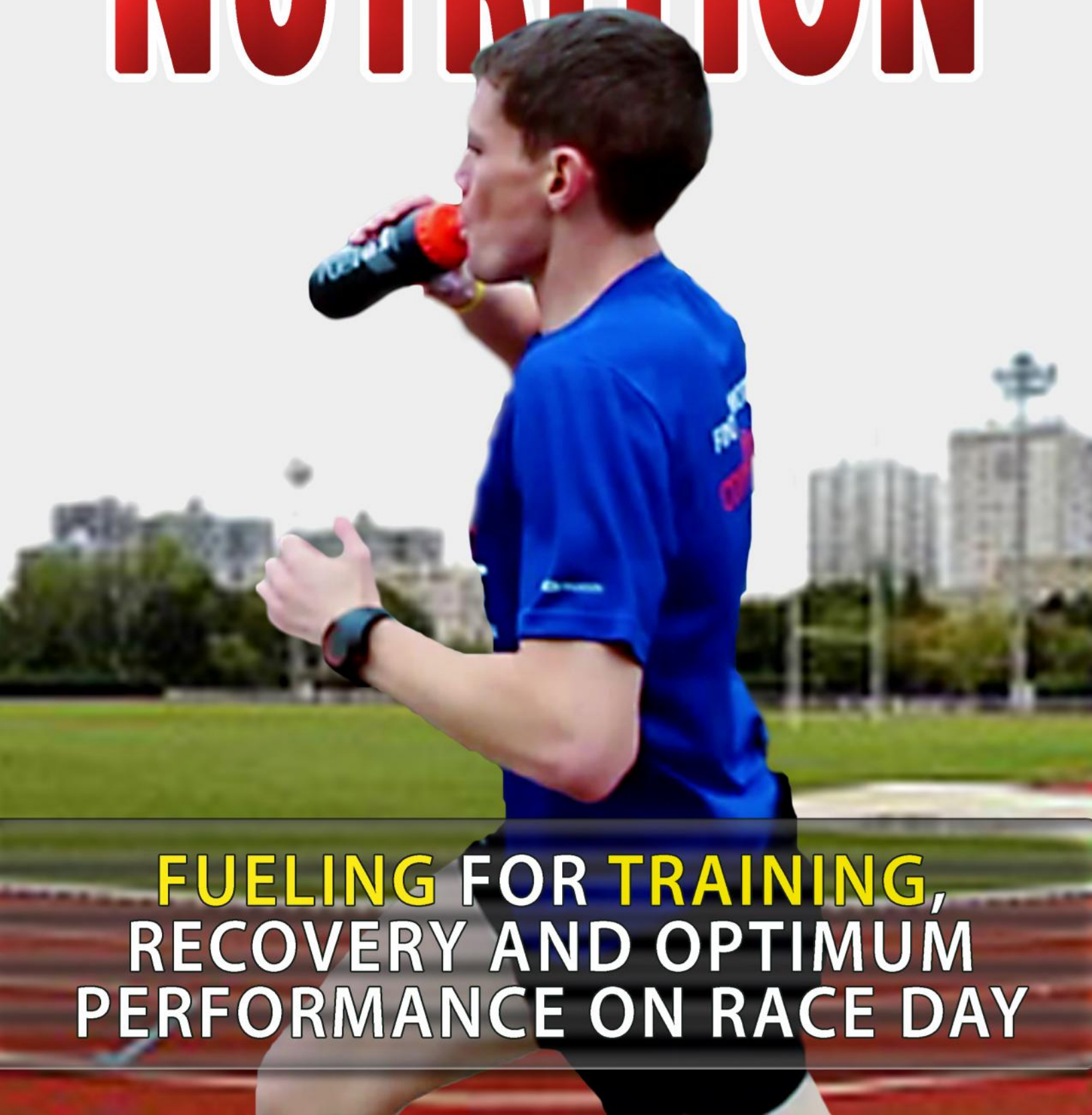
MARATHON NUTRITION



FUELING FOR TRAINING, RECOVERY AND OPTIMUM PERFORMANCE ON RACE DAY

Introduction

Jeff Gaudette
Owner/CEO

First, we want to say thank you for downloading the Marathon Nutrition eBook. This guide has been a labor of love and a collection of research, personal experience and conversations with some of the best coaches, nutritionists and minds in our sport. If you follow the principles outlined in this book, we are confident you can find the perfect nutrition strategy to fuel properly and succeed on race day.

Emily Brown
Nutritionist

One of our main reasons for writing this guide was to provide a simple and practical handbook you can follow and implement into your own training plan. If you have any questions, read anything you want to discuss in more detail, or would like our nutritionist Emily to write you a custom nutrition plan, check out our Nutritional Services Page

Melanie Schorr, MD
Team Physician

Finally, we want this information to benefit as many runners as possible. So, please feel free to e-mail it to all your running friends, share it via Facebook and Twitter, and get the word out. For the latest updates and information, you can visit our website, http://runnersconnect.net; follow us on Twitter @runners_connect; or join us on Facebook .

Happy Running,

The RunnersConnect Team

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The Three Energy Systems Used in Running

Should what you eat after a run change on an easy day versus a workout day? How about after a speed workout versus a tempo run? It's a very common question and a critical component to optimal recovery.

It's important that I first introduce the physiology of energy metabolism during different levels of exercise. Knowing the predominant energy system you are using during your workouts will help you determine your recovery needs for nutrition and rest.

Energy is stored in the body carbohydrates, fats, and proteins as well as in the molecule creatine phosphate. Carbohydrate and fat are the primary sources of energy, with protein contributing a minimal amount under normal conditions. Adenosine triphospate (ATP) is the body's usable form of energy. The body uses 3 different systems of metabolism to transfer stored energy to form ATP.

Energy Transfer Systems

The Phosphagen System

The phosphagen system of energy transfer does not require oxygen (anaerobic) and is utilized when there is a sudden increase in energy demand such as starting a workout, putting in a quick surge, like throwing a discus.

It is the most direct and quickest form of energy production but can only supply enough energy for a short burst of intense activity, like a maximum weight lift or a 5-second sprint.

This system relies on the availability of creatine phosphate, which is in limited supply and is depleted quickly. When creatine phosphate is used up, the body must call on other systems of energy transfer to sustain continued activity.

Glycolysis (anaerobic) System

Another system that doesn't require oxygen is glycolysis, which literally means the breakdown of glucose.

This system provides enough ATP to fuel 1 to 3 minutes of intense activity when adequate oxygen isn't available for aerobic metabolism.

Glycolysis is also known as the lactate system. Lactate or lactic acid is something that most runners have heard of and may even fear because of its connection with sore

muscles and fatigue. Hopefully the following explanation of glycolysis will help you picture what is going on.

Glucose is the only fuel that can be used during glycolysis. As glucose from food is converted into two molecules of pyruvate, the reaction creates ATP. Hydrogen is also produced during this process and if oxygen is present, the aerobic system (explained next) can use hydrogen and pyruvate to produce more ATP. However, oftentimes the aerobic system cannot provide enough oxygen to keep up with the excess hydrogen being produced and instead of creating ATP, the hydrogen combines with pyruvate to form lactic acid.

Lactic acid then enters the bloodstream and is cleared by the liver. **The point at which the production of lactate is faster than lactate clearance is called the lactate threshold**, also referred to as the anaerobic threshold, when lactic acid begins to accumulate in the blood. The increased acidity of the blood inhibits the use of fatty acids for energy production through aerobic metabolism and thus increases the body's reliance on carbohydrate and glycolysis. As blood lactate levels continue to rise and carbohydrate stores become depleted, the muscles begin to fatigue and performance is diminished.

An athlete can increase their lactate threshold through adaptations made during proper endurance training. This is where my knowledge of the lactate threshold ends and I leave it to the expert coaches to figure out the best way to do that!

I will say though that one of those adaptations is the increasing the efficiency of the aerobic system.

The Aerobic System

The aerobic system can use carbohydrates, fats, or proteins to produce energy. Energy production is slower, but more efficient than the other two systems. As you can tell by the name, the aerobic system requires that there be adequate oxygen available to the working muscles. Therefore this system is used more heavily during low-intensity activity.

One key highlight of aerobic metabolism is the ability to burn fat as fuel. Our bodies have a seemingly unlimited capacity for storing fat, and fat provides more than twice as much energy per gram than protein or carbohydrate, making it a very attractive energy source. **In prolonged activities where intensity is low, the body will use fat as the main energy component and spare the use of muscle glycogen and blood glucose so that it is available for use if exercise intensity increases and oxygen availability is decreased.**

Keep in mind that aerobic metabolism doesn't use fat exclusively. Although you may be burning mostly fat, a steady supply of carbohydrate is still necessary for the breakdown of fat into an energy source.

Just like the aerobic system isn't exclusive to one substrate, energy metabolism isn't exclusive to one system. All 3 systems are working simultaneously to fuel the body during exercise. However, certain characteristics, such as exercise duration and intensity will determine the predominate system and thus how long the activity can be performed at that level.

Other factors that influence what substrates and systems are being used include:

- fuels that are available
- fitness level of the athlete
- nutritional status of the athlete

These factors may change over time and through training so just like overall nutrition, energy metabolism is very individualized and dynamic.

Final Notes

One significant reason for having adequate fuel before a workout, as well as on a daily basis, is to prevent the use of protein as a fuel source.

Protein is usually spared from being used as an energy source and is used predominately by the body for tissue maintenance, growth, and repair. However, when glycogen stores are depleted, amino acids from muscle protein can be used to produce glucose. As we learned before, glycogen stores can be depleted through intense and prolonged exercise, a chronic low carbohydrate diet, or an overall low-energy diet that cannot keep up with the body's demands. **If the body consistently relies on protein for fuel, muscle protein stores will begin to decrease along with lean body mass, which can be detrimental to performance**.

This highlights the importance of fully replenishing glycogen stores after intense workouts, as well as on a daily basis.

What to Eat Before and After Easy Runs, Long Runs and Different Types of Workouts

What you eat after a hard workout affects your recovery and your ability to be ready for your next workout. Recovery (both physical and nutritional) is a critical part of an athlete's training but nutritional needs for recovery vary depending on a number of factors:

- The length and intensity of the workout
- The workout conditions
- Your current nutritional status and physical fitness
- When your next workout is

By learning about which energy system(s) we are using in our workouts in the previous section, you can have a better idea of what our body may need for optimum recovery.

A typical training regimen for an athlete may consist of one tempo workout, one VO2 max workout, one long run, and four easy/recovery runs. This may vary depending on the training block, but most of the workouts fall into one of these categories:

	Recovery/Easy	**Long Run**	**Tempo Run**	**VO2 Max**
Pace	1-2 minutes slower than ½ marathon pace	Sometimes easy run pace, sometimes faster running included	Between marathon and 10k pace	Between 5k and 1 mile pace
% Max HR	60-70%	75-85%	85-90%	95-100%
Example	4-10 miles	10-20 miles	Continuous run or longer intervals (e.g. 1 mile repeats)	Speed work such as short intervals (e.g. 400m repeats)

Not every athlete will have the same workout schedule or types of workouts, but thinking about the length and intensity of your workout will help you determine your nutritional needs.

Nutritional demands for different types of runs

Easy/recovery runs

These are exactly what they sound like - easy efforts. During these runs you will be burning a combination of carbohydrate and fat, with a greater reliance a fat which is good for maintaining glycogen stores.

Protein is usually spared from being used as an energy source as long as adequate carbohydrates and fats are available.

However, **if daily carbohydrate or energy intake is low or you exercise for longer than 60 minutes without eating before or during the exercise, protein may be used to meet energy demands.**

We want to prevent this as much as possible.

There are no major nutritional needs to worry about after an easy run. Just be sure to practice a normal daily habit of healthy eating, keeping in mind that any bit of exercise increases your overall nutritional needs for that day.

Long runs

While long runs may sometimes be run at an easy pace, they are longer efforts than easy or recovery runs, burn more calories and thus require more fuel. If you exercise in a fasted or under-fueled state and do not take in any calories while running, your body will want to get those calories back pretty quickly.

It is a good idea to consume a high-carbohydrate meal as soon as tolerable to jump-start the refueling process. Quality protein sources are also important to replace any that was used to meet energy demands.

As with easy or recovery runs, a normal day of healthy eating should replace these calories and nutrients lost, but you will need more calories than you would on a less intensive training day.

I like to think of long run days as my “cheat” day where I can be a little more relaxed about what I eat and drink. However, take in good recovery foods first before getting too crazy. Always be thinking about the next week’s workouts and what you need to do to be ready.

Tempo runs

Threshold training, or tempo runs, by definition approach energy production in the area between aerobic and anaerobic metabolism. The goal is to stay at or just below your lactate threshold to prevent the accumulation of blood lactate yet still train at a high level.

Interval training is a type of tempo run that allows you to slightly exceed your lactate threshold, and then recover back to the level below threshold before the next bout. Intensity is higher in this type of training so metabolism shifts to using more carbohydrate (blood glucose and muscle glycogen).

It is very important to start these types of workouts with full stores of muscle glycogen since these stores will likely be depleted by the end of the workout.

Your first priority after the workout should be to replenish your glycogen stores by ingesting carbohydrate as soon as possible.

VO2 Max

These workouts are about as intense as it gets for distance runners. While these efforts are usually short, they require a lot of power output. These efforts will call on the anaerobic system almost exclusively. This means your body will only be using glucose for energy and your stores may become depleted quickly.

Activity this intense can only be supported for 1-3 minutes at a time before a recovery interval is needed.

Nutritional needs after these types of workouts mimic those after a tempo workout, however the duration of the workout is probably shorter and you will have covered less total miles and caloric needs may not be quite as high. It is important to focus on high quality carbohydrates and protein to replenish glycogen stores and start the process of muscle repair.

Additional Notes

Nutrition plays a very important role in the recovery, but so does rest.

- Adequate rest enhances the recovery process and also helps reduce the risk of injury and chronic fatigue.
- Furthermore, the body needs 1-2 days of physical rest and adequate carbohydrate intake to fully replace depleted glycogen stores.

Fluid replacement should be a top priority, especially when conditions are hot or you lose a lot of moisture through sweating. Fluids and electrolytes, which play key roles in exercise and metabolism, are lost through sweat.

- It is important to replace what was lost as soon as possible.
- A good practice is to weigh yourself before and after a workout. For every pound lost, you should consume 16oz (2 cups) of water or sports drink.

Recovery nutrition is most important for competitive athletes training twice a day or on consecutive days.

If you are a recreational athlete or you have multiple rest days in between hard workouts, you do not need to be as concerned about immediate nutritional recovery. Just be sure to maintain a well-rounded daily diet with adequate carbohydrates.

Remember that **quality training is more important than quantity training**. If you try to force workouts in when you are not fully recovered, you will not get the training result you are looking for and may set yourself up for injury.

The Science of "Bonking" and Glycogen Depletion

Bonking" in a marathon is a miserable experience.

Bonking, or "hitting the wall" as it is also referred, is a phenomenon well-known among marathon and ultra-marathon runners that occurs when your body's sugar stores deplete during a run.

Sugar, stored in your liver and muscles and bound into large chains called glycogen, is the primary fuel for a distance runner.

While your body can burn fat directly for energy, it tends to prefer glycogen, as it is easier to burn.

Much of **the lore about the marathon being "half over at twenty miles" has to do with the fact that this is about as long as the average person's muscle glycogen stores will last.**

In this chapter, we're going to look at the science of "bonking" to help you develop a proactive nutrition strategy and run at your absolute best on race day.

The science of glycogen depletion

An intriguing computational analysis of glycogen depletion, published by Benjamin Rapoport of Harvard University in 2010, illustrates that "hitting the wall" during a marathon is contingent on the following:

- amount of glycogen you store in your muscles
- how fast you run
- pacing strategy
- body size
- muscle mass

There's a lot of overlap between these variables—for example, a faster pace burns a higher percentage of glycogen vs. fat, but also allows you to cover ground faster—but **the bottom line of all of it is that most people don't have the glycogen reserves to make it all 26.2 miles of a marathon at a fast pace without running out of fuel.**

Additionally, there's a factor that Rapoport didn't take into account: New research suggests that the brain anticipates glycogen depletion and slows the body down gradually to conserve energy.

In fact, the brain's role in regulating the relationship between energy metabolism and running performance may be significant. While it is well documented in exercise and nutritional science that consuming carbohydrates improves performance in long (2+ hour) competitions, simply rinsing your mouth with a carbohydrate drink, then spitting it out, seems to help too.

Obviously, sugar after brief contact with the inside of the mouth would not diffuse markedly into the bloodstream; the performance boost likely comes from the brain sensing that more carbohydrates are on the way.3 So it's reasonable to deduce that even before your body actually runs out of glycogen performance would be impaired.

It's a given that on race day, you'll want to be consuming some kind of carbohydrate during competition. But what about during training?

Marathon Long Runs on an Empty Stomach or Fully Fueled

Running coaches and exercise physiologists have long debated the potential benefits and disadvantages to performing long runs during marathon training on either an empty stomach or fully fueled. Unfortunately, scientific literature hasn't provided runners with a clear-cut recommendation.

However, by looking at the available evidence, and combining that with practical examples, we'll show you how you can use both in your training to maximize performance.

The Role of Glycogen in Marathon Racing

One of the most important determinants of marathon success is how efficiently your body can use fat as a fuel source as opposed to carbohydrates. The more readily you can burn fat while running at marathon pace, the longer your glycogen stores will last – providing crucial energy for that last 10k.

Your body has a limited supply of glycogen available to fuel your working muscles. **Most research has shown that you can run about 2 hours at marathon intensity before you run out of glycogen.** For all but the fastest runners in the world, this is going to leave you far short of your goal.

Unfortunately, while helpful in extending glycogen stores, **simply eating on the run won't entirely replace all the glycogen you burn.** Midrace fueling is limited by how quickly your digestive system can deliver the glycogen to your bloodstream and, under the duress of marathon racing, the stomach is not very efficient.

Therefore**, it is critical that you find ways to optimize the amount of fat you burn while running at marathon pace**. One of the most obvious places to look for these improvements is in the long run.

The Case for Glycogen-Depleted Long Runs

The theory behind running your long runs on low glycogen stores is that by not having readily available muscle glycogen to burn, you body is forced burn fat. Consequently, your body will become more efficient at using fat as a fuel source. The real question is, does this theory hold true?

A 2011 study by Karen Van Proeyen et al. investigated the effects of training in a glycogen depleted and glycogen-replenished state using twenty young male cyclists.

The men were split into two groups, both of which had equivalent diets and training regimens. The first group did all of their training after an overnight fast, while the second group took a carbohydrate-rich breakfast about 90min before their daily training session (a 60-90min bike ride at a fairly hard pace in the morning).

After six weeks of training, both groups had improved a similar amount on a 60-minute time trial. However, there were several changes in the "fasted" group that indicated that their bodies had adapted to more efficiently burn fat as fuel.

- First, levels of enzymes associated with fat metabolism increased significantly in the group which trained after the overnight fast, but not in the group which had a large breakfast before training.

- Additionally, their fat utilization increased throughout a range of intensities. That is, they could maintain a given pace with less reliance on glycogen, enabling them to last longer in a race without hitting the wall.

Another study (albeit of lower quality, as it used only a handful of untrained men as subjects) by Nybo, et al., confirmed the findings of the Van Proeyen group. The subjects who trained in a fasted state in the Nybo, et al. paper also increased their fat burning abilities more than the carbo-loaded subjects; furthermore, they also increased their stores of muscular glycogen.

While you might suspect that these changes would have enabled these untrained men to lose more weight, **there was no difference in the weight lost between the men who trained after an overnight fast and the men who did not**.

Other factors related to training and glycogen depletion

So, it appears that doing some training in a glycogen-depleted state can be of benefit to marathon runners. But there are some important considerations.

First, keep in mind that the fasted-training subjects in the Van Proeyen and Nybo studies did not get in better shape than the carbo-loaded subjects! Their improvement from training was identical; the only differences were related to fat metabolism.

If you were training for a relatively short race, like a 10k or a 5k, there would be no advantage to doing long runs after an overnight fast—the race isn't far enough for glycogen storage to become a factor.

Second, the ability to run a given pace with less reliance on glycogen does not necessarily mean your aerobic endurance has improved (i.e. your oxygen consumption at the given pace).

Moreover, other studies have gone further and tested the effects of training with low-glycogen levels for more than one run or for extended periods of time. The research concludes that ***extended carbohydrate depletion impairs performance*** **and does not enhance fat utilization**.

The research makes a strong case that **occasional** long runs in a fasted state will improve glycogen storage and fat utilization, but extended training or multiple long runs in the fasted state will impair performance and does not provide further benefits to fat utilization.

The Case for Glycogen Loaded Long Runs

Another strategy for improving marathon fuel efficiency is maximizing glycogen storage during long runs.

During a marathon training cycle, you have a limited number of workouts and long runs from which you can gain fitness. Therefore, it is important to maximize each opportunity to make progress. Completing the majority of the long runs in a glycogen-loaded state increases the chance that you will be able to complete the run at maximum capacity, improving the overall quality of your long run.

Furthermore, carbohydrate intake before a long run aids post-run recovery by reducing muscle fatigue and overall damage to the muscle fibers.

Likewise, glycogen loading provides the muscles with essential nutrients that promote the restoration of glycogen for subsequent training sessions, improving the consistency of your training.

Finally, practicing fluid and nutrient intake during your hard training sessions is essential for race day success. Not only do you need to practice the skill of drinking from a cup while running fast, but you need to train your stomach to handle liquids and gels without getting upset.

Practical Applications for Your Training

With scientific evidence supporting long runs in both the fasted and glycogen loaded state, how do you decide which is best for your marathon performance? My suggestion is to methodically utilize both approaches:

You should run your early training segment long runs in a glycogen depleted state. This will teach your body to boost glycogen stores and increase fat as a fuel source early in the training cycle. However, because the long runs won't be as long as late-stage training runs, you don't run a high risk of bonking and sacrificing a critical 20- or 22-mile long run.

Run your last three quality long runs in a glycogen-loaded state. In doing so, you will increase the overall quality of these important long runs, enabling you to finish faster, and recover more quickly in anticipation of race day. Likewise, practicing your competition nutrition strategy, which includes ingesting glucose during competition, in advance will condition your digestive system to process simple sugars and fluids efficiently.

By implementing both glycogen-depleted and glycogen-loaded long runs, you can improve the critical fuel efficiency element necessary for running a marathon while maintaining consistency in your training.

Do you have questions about how to incorporate these types of long runs in your training? Just ask one of our coaches and we would be glad to help.

Marathon Nutrition – Practice Makes Perfect

Practice makes perfect. Any baseball, basketball, or football player will tell you it's been a mantra repeated to them throughout their years of competitive play.

Unfortunately, runners often forget this time-honored rule when it comes to racing.

We get so preoccupied with the physiological training adaptations needed to make gains in fitness that we often forget that racing itself is a skill.

This is especially true in the marathon and half marathon because, on top of skills like pacing and mental toughness, you're adding the variable of regulating energy and fluids.

The last chapter discussed the specific training workouts you can implement to ensure that you don't bonk during the marathon.

However, this chapter will discuss the exact skills you need to practice during training to maximize your ability to consume and process energy gels and fluids during a race.

Getting Your Stomach Accustomed to Eating and Drinking on the Run

One of the main problems with eating and drinking on the run is that it is difficult for your body to process the nutrition you consume.

As you run farther and harder, your body becomes increasingly distressed. As your effort continues to increase, your body diverts energy from non-essential functions, such as digestion, to your muscles and brain to keep you going at the pace you're running. So, when you consume those energy gels and jelly beans, it takes much longer for them to reach the bloodstream where the muscles can use them for energy. Sometimes, if the digestive system isn't working optimally, your body will actually reject the fuel or fluid you put into it, which is why many marathoners often experience stomach issues.

To train your body to become more efficient at processing nutrition during a race, you need to practice during your training runs. However, this doesn't mean practicing taking energy while running at an easy pace – it's not specific to what you're doing in the race.

You need to practice eating and drinking when your body is under duress, like during a marathon paced run, tempo run, or even during fast portions of your long run.

This will specifically train your body to become more efficient at processing nutrition while running hard, which is exactly what you want to accomplish on race day.

Get even more specific

The running industry is filled with nutritional products that are designed to help you fuel during a marathon.

You have gels, jelly beans, shot blocks, bars and of course a myriad of drinks such as Powerade and Gatorade.

Therefore, it is important you find out which type of product you like best.

For some, the consistency of gels is unpleasant and can make them gag, while others love the taste of gels and their stomachs can't handle anything more solid.

Each person reacts differently, so it is essential that you start practicing early in your training with different products to find the one you like best.

Waiting until race day is a sure fire way to fail.

If you think finding the right type or brand of energy product is difficult, you also need to find the right flavor.

I can't count the number of flavors available for energy gels and nutrition products; however, each one can react with your stomach in a different way.

Also, don't just blindly trust what you think you normally like.

I had a teammate who was a very good marathoner (sub 2:15 pr) and he loved chocolate; yet, when he tried a chocolate energy gel during a marathon paced run, he nearly threw the whole thing up. For a professed chocolate lover, it was near blasphemy, but it was an important lesson he learned in training.

While many of the products and brands are roughly equal in terms of quality, avoid those that contain protein.

Your body can't digest protein easily when running, and while it's been proven to help with recovery, I haven't seen any convincing science that proves it helps with fueling.

If you're going to rely on what products are available on the course, you must practice using them before race day.

Do some research on the official race website and find out what will be offered on the course. Go to the store and get the same exact flavors and brands. This may seem like overkill, but the slightest change in routine can leave you in for a rough day of racing.

For example, in the 2008 Olympics, race favorite and 2:04 marathoner Paul Tergat finished in a disappointing 10th place due to cramps caused by drinking cold water supplied by the race.

Tergat had practiced drinking fluids that were room temperature.

In the marathon, you cannot over plan.

Develop a strategy

Finally, it's important that you develop in advance a nutrition strategy for race day. This will include exactly when you'll plan on taking fluids and nutrition and how you plan on taking them.

Will you bring you own water bottles or will you use the water stations available on the course? Will you walk through the stations or will you attempt to run through them?

Running or walking through the station is an individual choice, but I suggest that if you're attempting to run sub 3:45 for the marathon or sub 2 hours for the half marathon that you run through them.

However, slowing your pace a bit to ensure you maximize consumption is fine. If you're planning on a finish slower than 4 hours, you will benefit more from walking through the station and getting in as much fluid or fuel as possible.

If you're using your own water bottles, make sure you've practiced with them beforehand. You don't want any unnecessary chafing from wearing a water pack you didn't try first.

If you're going to use the aid stations available on the course and plan on running through the water stops, I suggest heading to the store and picking up some paper cups. Take them to the track and fill them with water and set up a table to put them on (or if you have young kids who love helping, you can have them hold the cups for you).

Practice running at a little faster than marathon pace, grabbing a cup, and taking a drink. I guarantee that the first couple of times you run through your makeshift water stop, more water will end up on the ground or up your nose.

Here is a hint: Grab the cup and pinch it at the top on one end. This will make one end more of a funnel and also prevent the water from splashing out as easily.

Also, remember that you don't need to get all the water down in 5 seconds; you can take your time while drinking and remember to breathe.

The marathon is a long event with the potential for many things to go wrong.

However, the more you can practice during your training, the greater your chances of success.

By developing a comprehensive fueling strategy that includes practicing the specifics outlined in this article, you'll be on your way to a great run on race day.

How to practice your long run nutrition to find your sweet spot

In mid-summer and mid-winter, many runners are starting to build up higher mileage as they prepare for marathon and half marathon races in the spring and fall.

With this natural increase in both mileage and long runs comes good and bad experiences in regards to nutrition on the run.

Typically, once you have had a bad experience with digestion or food on a run (like bonking or the call of nature) you tend to shy away from whatever you did before that run in an effort to avoid that negative experience.

Good idea.

However, instead of making *minor* nutritional changes to avoid these experiences, many runners make multiple and drastic changes all at once. The result is experiencing yet another rough run without a more concrete idea of what is and isn't working.

This uncontrolled approach and fear of more bad runs often derails athletes from zeroing in on a nexus of nutritional and physical training that works, which is inherent to successful race performance.

To help, I would like to share some strategies that will allow you to become more in-tune with and discover your body's nutritional sweet spot during long runs.

Let me tell you a story of a runner who struggled with long-run nutrition

Let me tell you a story about a runner friend of mine named Crystal.

After experiencing the call of nature mid-way and then proceeding to bonk three quarters through a long race, Crystal decided to make two changes in the hope of avoiding re-experiencing the two negative outcomes.

First, Crystal decided to wake up earlier and finish eating two hours before her next long morning race. This change was made to allow time for complete digestion and a bathroom break before the run's start.

The second change was to nearly double her gel intake. Instead of taking a gel every 45-60 minutes, Crystal started using a gel every 20-30 minutes.

Thinking that drastically changing these two factors was the right call, Crystal went out on her long run the following week.

Unfortunately, the end result of these changes for Crystal was low energy and bloating that started in the final couple of miles of the run, which then continued for a period of time after the run was complete.

Crystal made a common mistake by making more than one routine change at a time. In doing so, she experienced two or three additional bad runs and still didn't have a better idea of how to correct the issue.

Where most runners go wrong when trying to fix nutrition issues

There are three issues Crystal, and many other runners, get wrong when trying to make meaningful nutrition changes in an attempt to avoid the dreaded bonk or stomach issues during their long runs.

- First is being afraid to have another bad run and therefore trying to fix everything in one fell swoop by the next run. It's important to consider each long run as "practice" for the actual race, and each gradual change will benefit the final performance.

- Second, applying the minimum nutrition requirement to optimize performance is always the best philosophy when it comes to endurance events. If one gel is helpful, do not add 15 additional gels to make you 15 times faster. Add each additional gel gradually until the correct level is achieved.

- Finally, making multiple changes at once makes the actual effect of each change unclear; to gauge the benefit of each individual change, apply each one separately.

How to get your long-run nutrition right

Don't Fear the Negative

When it comes to nutrition for endurance events, remember that you are bound to have negative experiences – it's unavoidable and part of the process.

While there are many great guidelines that indicate what to eat before, during, and after a long run to avoid bonking and the call of nature, you have to remember everyone's body is different. Somewhere along the line your body is not going to fit into the general guidelines, and you may experience a hard run or two until you find the correct balance.

Don't be afraid of the hard runs and negative experiences

Just like in other areas of life, it's often the negative experiences that we learn the most from.

If you have an awesome 20-miler, how often do you take the time to go back and rethink what you ate the day or two before the run or the morning of the run—probably not that often.

On the other hand, when you have a terrible run, you are much more likely to think to yourself, "What in the world did I eat recently? That was a hard run!"

I recommend experimenting with what you eat before, during, and after each run while you are training.

Yes, you risk a bad run or two, but with trial and error you also open the possibility of discovering a combination of foods that gives you more energy than what you are currently experiencing.

Use each long run leading up to your final long run as experimental practice runs. Make minor adjustments in nutrition to determine if it is a positive and beneficial change or not.

The last long run of your training routine should be a dress rehearsal for race day. You should have your pre-race meals (the day before and the morning of), as well as any gel use and hydration requirements determined well in advance.

Less is best

When it comes to fueling and refueling during endurance running, research has shown us that less is best.

On average, a runner burns 100 calories per mile. Therefore, an individual can burn anywhere from 400-800+ calories an hour.

A common misconception is that runners need to consume most of those burned calories while running or they will hit "the wall."

The perpetuation of this myth has been the source of many uncomfortable, bloated runs for a signficant number of runners.

When running at a moderate or high intensity for over 1-2 hours, your body simply cannot keep up with the calorie or fluid loss. It doesn't matter how much you eat or drink, your digestive system can only process so much while running.

Fortunately, your fat and muscle glycogen stores are sufficient to make up for the non-replaceable nutrient losses, if trained properly.

The standard recommendation for endurance athletes it to consume 240-280 calories per hour of training. What this recommendation doesn't specify is that it is based on a 165-pound athlete.

If you weigh more than 165 pounds, or less than 165 pounds, 240-280 calories per hour of running is not your "prime" calorie consumption. This is one reason I emphasize the importance of experimenting with your own body's nutritional requirements.

If you are experiencing digestive discomfort or bloating during a run, often cutting down on the amount of gels or chews you are using is a great first routine change.

If that doesn't take care of the problem, look at the ingredients in the product you are consuming.

You may be allergic or sensitive to a particular ingredient; try other brands with varying ingredients or try real food that you are not sensitive to that will supply your body with the same energy boost.

Make one change at a time

If you are interested in really taking the time to learn your body, and you enjoy taking risks, try the following experimental process of making one change at a time to help you find your nutritional sweet spot:

Begin with a blank slate. During a long run, don't take anything with you but water. See how you feel, and ask these questions:
-Did you get hungry? During which mile?
-Did your pace slow down? During which mile?
-Was your overall time faster? Slower? By how much?

The nutritional routine in the next long run will depend on your answers. For example, if your last long run was a 16-miler, and at mile 14, you crashed. For your next run, take one gel with you and take it at about mile 12.

Again, ask the same questions listed above. Continue this process for each long run, making small adjustments, as needed, each run. This process would allow you to see what works specifically for your body.

It will also teach you how to be incredibly in tune with your body's needs.

When you go through this trial-and-error process, you will begin to notice how your body feels miles before you bonk, which gives you the information you need to prevent this from happening – a result that following generic guidelines cannot offer.

External elements, like sleep and stress, will probably intercede and prevent precisely repeatable results– e.g. always bonking at mile 14.

But, by implementing the process of listening to your body, you can notice how you feel three to four miles before you hit the wall, thereby preparing you to make critical nutritional adjustments on the fly.

Bonking, crashing, "hitting the wall," and "calls of nature" are never fun, but they are nothing to fear, either.

Each negative experience you have can better prepare you to supply your body with what it needs to be stronger for your next run.

As you get into longer miles this winter or summer, take the time to learn your body's preferred nutritional sweet spots. It is well worth the time and effort!

Sports Drinks vs. Water: When It's Best To Use Each

Most runners have repeatedly heard they must drink plenty of fluids as the summer months approach or when heat waves strike.

Well duh, who doesn't drink more when it's hot outside?

Instead of boring you with yet another "news flash" about how you need to drink more when it's hot, I'm going delve into some of the specifics of summer hydration

- when you should be drinking water versus when you should be drinking sports drinks (or an electrolyte beverage)

- how to calculate exactly how much fluid you need on any given training run.

To preface, this chapter is about hydration and drinking protocols during training, not during a marathon race or while you're practicing your marathon nutrition strategy.

During marathons or fueling for marathon-specific long runs, refueling is an important and entirely other topic.

Fluid absorption rate

First, it's important to understand how sugar and electrolytes impact your fluid absorption rates.

The speed at which water, electrolytes, and sugars can be absorbed into the bloodstream is one of the main determinants of what type of beverage you should choose when trying to stay hydrated.

The absorption of fluids into the body is largely dependent upon two factors:

(1) the rate at which it is absorbed through the walls of the small intestine

(2) the speed at which it is emptied from the stomach.

Both of these factors are controlled by its carbohydrate (sugar), and electrolyte concentrations.

As a general rule, the higher the carbohydrate content of your beverage, the slower the absorption rate will be.

Consequently, trying to maintain proper hydration and balanced electrolyte levels during a run with sugary sports drinks is difficult.

On the other hand, plain water passes through the body too quickly and without providing the necessary sugar to spark the insulin response and ignite the recovery process.

Therefore, your choice for hydration will depend on whether your primary aim is rehydration (keeping the body cool and maintaining fluid balance) or the replenishment of energy (sugar and electrolyte stores).

What is best to drink before and during running

Most sports drinks on the market are what sports scientists call isotonic, which means they contain a carbohydrate solution that is at 6 – 8 percent concentration considered optimal for absorption and carbohydrate fueling.

These beverages have a mid-level absorption rate. Water is the most readily absorbed (hypotonic) and something like fruit juice, being greater than 8 percent sugar concentration (hypertonic), being the least absorbable.

Because the sugar concentration of most sports drinks is higher than that of most body fluid, they are not readily absorbed into the blood stream and are thus not optimal for hydration.

Before and during your run, rehydration should be your main priority. When training in warm conditions, rehydration will allow you to maintain fluid balance and stay cool.

Accordingly, **your best choice before and during your run would be water, a heavily diluted sports beverage, or water with electrolyte tablets**.

By drinking water alone, diluting your sports drink, or using electrolyte substitutes, you provide your body with the best combination of electrolyte replacement and immediate absorption.

Likewise, electrolytes, especially sodium and potassium, reduce urine output, speed the rate at which fluids empty from the stomach, promote absorption in the small intestine, and encourage fluid retention.

Furthermore, not only do you want to shy away from consuming unnecessary amounts of simple sugar when you can avoid it, research shows that when a runner consumes high-glycemic (GI) foods, like high-sugar sports drinks or energy bars an hour before a run, he or she may become fatigued more quickly.

What to drink after running

After you are finished working out, water or a diluted sports drink is not the best choice for your recovery needs. Water and diluted drinks do not contain enough of the sugars and electrolytes that your body needs in order to bring itself back into balance.

In addition, because water or highly diluted drinks are rapidly absorbed into the bloodstream, consuming high quantities results in a rise in plasma volume (in non technical terms, this means your body is oversaturated with water). This rapid absorption leads to a further imbalance of electrolytes and frequent bathroom stops, which will only increase fluid loss and decrease your desire to drink.

Your best choice post workout is a drink that contains a fair amount of sugars, electrolytes and possibly some protein. Scientific literature has consistently shown that drinking a beverage that contains a 4 to 1 ratio of carbohydrates to protein is optimal for recovery. Therefore, at the very least, you should be drinking a sports drink after you exercise to help ignite the recovery process.

Calculating your sweat loss for optimal hydration

When it comes to losing and rehydrating and replenishing electrolytes every runner is different. Some runners are “salty sweaters” and some people sweat very little.

The most efficient way to rehydrate properly is to put back exactly how much fluid you’ve lost while running.

This will help you avoid an upset stomach from drinking too much, becoming a victim of hyponatremia (low sodium), or not drinking enough and becoming dehydrated.

Unfortunately, most generalized advice doesn’t cut it when it comes to how much you need to rehydrate: Some say drink to thirst, which may not keep up with your own body’s fluid loss rate if you sweat heavily; or 8-10 oz per hour, which doesn’t factor in temperature, humidity, or environmental factors.

This makes rehydrating properly sound daunting, but calculating your exact fluid loss in any given temperature and humidity is actually quite easy if you use a sweat loss reference chart.

All you need to input is your weight before and after each run, any fluid taken, fluid lost through going to the bathroom, and the distance/time you ran.

You’ll now have an easy reference chart for exactly how much fluid you need to replenish on any given run and in any given temperature. This will help you avoid dehydration, over-hydration, or getting a sloshing stomach.

Why You Might Gain Weight While Training for the Marathon

Whether you are an elite runner or a first time marathoner, training for the 26.2 mile distance requires months of training and countless hours and miles recorded out on the roads.

It only makes sense that this kind of demanding training regimen would result in significant weight loss for anybody crazy enough to take it up.

So why do some runners report actually *gaining* weight during marathon training? Is that even possible?

If you are one of those runners who is experiencing this anomaly, there may be a few explanations as to why this could be happening.

In this chapter, we'll outline three possible reasons you might gain while training for the marathon and hopefully help you understand that it may be a normal occurrence.

Gaining Muscle Mass

You body responds to exercise by making a number of adaptations and physiological changes. One such change is the formation of muscle mass.

Yes, even distance running can promote muscle growth, especially in the leg areas that used the most. Add into that any weight-lifting and -strengthening exercises and BOOM -> muscle gain!

Muscle mass is denser than fat mass, meaning that one pound of muscle takes up less space than one pound of fat.

If your body looks the same or even trimmer, yet you are heavier on the scale, the addition of muscle mass could be the cause. And that is not a bad thing.

Storing More Glycogen

Untrained athletes who begin an endurance-training program can increase their body's ability to store muscle glycogen by 60-70 percent. Endurance-trained athletes consuming a high carbohydrate diet and/or carbohydrate loading can also increase muscle glycogen stores by nearly double that of the untrained state.

For every ounce of glycogen the body stores, it also retains 3 ounces of water. That extra water your body stores will record as "weight" on the scale.

Water weight will fluctuate throughout the days and weeks and is not reflective of fat mass weight gain. Remind yourself that the higher number on the scale is good and represents being able to store extra glycogen and fluids. You will need this for training, and particularly on race day.

Overestimating your energy needs

One common mistake that runners make, veteran or newbie, is overestimating their energy needs, or how much they need to eat in response to their training. It seems like logging 20 miles on the roads over the course of a few hours should give us a free pass to eat anything our hearts (or stomachs) desire.

But overestimating how much we actually need and worse, making bad choices because we feel like we've "earned" it is easy.

The amount of calories we burn during a run is variable depending on the pace/intensity/duration of the run and size of the athlete, but in general we can expect to burn between 80-100 calories per mile.

For convenience sake, let's say I burn 80 calories per mile and just ran 20 miles. Here are two scenarios of what could happen next:

Hidden calories

1) I shower up and head out to the local bar for the 12pm Packer game. I am starving and feeling like I deserve a treat so I order a basket of boneless buffalo wings and fries. This could be anywhere from 800-1000 calories, depending on if I am in a sharing mood. Add with the ranch dipping sauce, we are talking another 200-300 calories. Now let's add the 3-4 pints of beer (Miller Lite because I am "health conscious" and from Milwaukee): another 400-500 calories. Grand total? 1400-1800 calories

During my 20 miler, I burned about 1600 calories. I easily made up this amount and more with food that didn't offer much in terms of nutritional value. If I fueled myself during the run with gels or sports drinks, which may have been necessary, then my energy intake is higher than what I burned.

Although it seems that I needed to replace the calories burned during my run, I overestimated the amount, how quickly the calories can add up and the consequences of refueling with empty calories rather than nutritious foods.

Not eating soon enough after a run

2) Maybe the Packers play the late game so instead I go home, shower, and pass out on the coach for a few hours. When I wake up, I feel ravenous and looking for the quickest, easiest thing I can eat. Cereal looks good. Three bowls of Fruity Pebbles later, I am still hungry, but now with a taste for sugar. Onto that pint of ice cream I tried to hide in the back of the freezer. Once that is gone my stomach really starts to hurt and I begin to realize that I made a mistake.

This gluttony example is a bit of an exaggeration compared to a standard overindulgence scenario, but the point is that sometimes we do not want to eat right after a run or we are so exhausted that we would just rather rest a bit. Unfortunately, our bodies' needs outweigh our preferences – they want food, and they want it now.

The longer we wait to replace what was lost, the more attractive the sweets and fatty foods become because sugars are easily absorbed and fats supply the most energy. Naturally, these are the foods our bodies will crave in the pursuit of refueling as quickly as possible**.**

Your hard work towards weight regulation can be negated by these momentary judgment lapses that result from making over-indulgent or –compensatory food selections.

Final Notes

- Weight gain during marathon training is more widely experienced than commonly perceived. It is important to think about the reason(s) that may be causing it. Increased muscle mass and glycogen storage are positive, and while another cause -- calorie overindulgence to compensate for an energy expenditure -- is unhealthy, it is something you can fix to get back on track.

- Save sports drinks and gels for your long runs and workouts or when weather conditions are very hot, when calorie and glucose supplementation is necessary. Otherwise, taking the extra calories is unnecessary. A low-calorie electrolyte supplement is an effective substitute.

- Remember that as you start training more, your net resting time may be higher -- formerly routine physical activities, such as weekend hikes, mowing the lawn, cleaning out the attic, etc. – could be downsized in favor of running.

- Finally, remember that a number designation on a scale is just one measure of overall health and fitness. Transfer your attention to other physical training markers – how fit and toned you look and feel, the improved fit of your clothing, and lower body fat percentage.

Part II: Nutrition For The Marathon Taper

Nutrition During the Marathon Taper

During extensive marathon training, you will build strength, endurance, and confidence in your ability to take on the marathon.

At the same time, marathon training can break you down. It will break down your muscle fibers, deplete you glycogen stores, and leave you feeling tired and fatigued.

The marathon taper, the period between training and a race, is such an important component of training during which to heal any damage and to fill your muscles' glycogen stores.

This chapter is a dietary guide for maximizing energy stores during a taper and regulating weight optimally.

Decrease Calories, Keep Up Carbs

The biggest mistake most marathoners make during a taper is not cutting down on food intake even though they are exercising less and burning significantly fewer calories.

Most marathon taper plans start with the last long run 3 weeks out from race day, with running volume significantly decreasing each week. Since you will be exercising less, you don't need as many calorie s as you did when you were burning them in training.

If you normally ran 10 miles in a day while training, and during the taper you only ran 6, you would burn approximately 400 calories less.

The excess calories not being used for exercise can be used to load up your muscle glycogen stores, but they could also accumulate into unwanted weight gain.

To be sure that you are adding to your glycogen stores and not just promoting weight gain, you must pay special attention to slowly decreasing your overall caloric intake while maintaining adequate carbohydrate intake.

In order to decrease calories but keep up carbohydrate intake you will have to trade some of the calories coming from fat for more carbohydrates. Fat should still contribute 20-25 percent of your total daily calories, but since you will be eating fewer calories this will mean less total grams from fat.

The following are some swaps you can make to cut down on fat and increase carbohydrate:

- Pancakes with maple syrup instead of butter

- Pasta with tomato sauce instead of cheese or a cream-based sauce
- Salad with an extra dinner roll instead of full-fat dressing
- Extra plain baked potato instead of “fully loaded” (butter, sour cream, cheese)

The goal for carbohydrates should be to maintain a daily intake of 3-5 grams per pound of body weight (6-10 g/kg). For a 150-lb athlete this will be approximately 450-750 grams (1800-3000 calories).

That is a lot of calories, so you have to be smart about keeping to a number within that range that is relative to your overall caloric needs. If you only need 3000 calories per day, then 450-500 grams would be adequate. Your body size plays a role as well. Smaller athletes should aim for the higher end of their range while larger athletes should stick towards the lower end.

You can double your muscle glycogen stores with adequate carbohydrate intake. You also learned that extra glycogen stores extra water, which shows up as extra weight. This is nothing to be concerned about. **If you are properly carbohydrate loaded, you should expect to be 2-4 pounds heavier due to the extra water stored in your body.**

Protein for Maintenance and Repair

Protein is needed to repair and reverse muscle damage and fatigue resulting from prolonged distance training. The goal for protein should be approximately 0.6-0.7 gram per pound (1.3-1.6 g/kg). Going back to our example of the 150-lb athlete, this would be 90-105 grams of protein per day.

This can easily be achieved by having a couple of servings of lean protein (chicken, turkey, roast beef, fish) or protein-rich foods (eggs, beans, tofu, lentils) each day as well as dairy products, which are good sources of protein and carbohydrate.

Keep in mind that many grains can contribute protein, as well. One serving of pasta (2 dry ounces) has about 42 grams of carbohydrate and 7 grams of protein. One slice of whole-grain bread has about 20 grams of carbohydrate and 4 grams of protein.

Choose More Fiber, Less Junk

Eating foods rich in fiber promotes regular bowel movements while eating too many refined products (white bread, pasta, rice) can lead to constipation, especially when training has been decreased.

Good sources of fiber include fruits, vegetables, and whole-grain breads, pastas, and cereals. Fruits and vegetables are also a good source of antioxidants, which can boost

the immune system and ward off illness. Be careful not to overdo it on fiber as it could unwittingly cause runner's diarrhea and subsequently bring about dehydration and electrolyte imbalances. Popular fiber bars or other fiber-enriched foods are not necessary. Stick with the foods you normally eat and are comfortable with.

Remember that you are exercising less, so you need to make each calorie count. **Don't waste it on "empty calories" like cookies, candy and ice cream that may have fit in while you were training hard**. Save those treats for after the race and **use the last few weeks to hone in on good nutrition practices to optimize your performance.**

Hydrate

Dehydration can significantly impair performance, but it is preventable with adequate hydration in the weeks, days, and hours leading up to the race.

To ensure you are properly hydrated, sip on fluids throughout the day. Water is sufficient, but juices and sports drinks can help meet your carbohydrate needs if you find that the food volume is too much. However, don't rely solely on these beverages since they contain a lot of sugar.

Instead of looking for a specific number of ounces to drink, I implore you to use your body's own measures of hydration. You should have to urinate every 2-4 hours and your urine should be pale yellow. If it is darker, then hydrate more. If it is clear, you may be hydrating too much.

Carbohydrate Loading: 3 Effective Methods to Increase Your Chances of Marathon Success

Carbohydrate loading, also referred to as "carbo-loading," is a familiar term among athletes of all abilities levels and sports.

To most runners it is often used to describe a large pasta dinner the night before a race or the consumption of massive amounts of carbohydrate justified by statements such as "I run a lot, so I can eat this."

It is true that carbohydrate is the body's major fuel source and is a crucial component of the distance runner's diet. However, true carbohydrate loading is a systematic and scientific practice that takes course over the weeks and days leading up to a competition with the purpose of maximizing the storage of glycogen in muscles.

The following is a simplified break down of the who, what, when, why and how of carbohydrate loading and tips for how you can make it work for you.

Who can benefit from carbohydrate loading?

Carbohydrate loading is only effective for endurance events lasting longer than 90 minutes, such as marathons and triathlons.

During intense, continuous endurance exercise, your muscles will become depleted of glycogen after about 90 minutes. Carbohydrate loading is meant to store extra glycogen that your muscles can tap into once the normal stores are used up.

Any extra glycogen in the muscles may actually be detrimental to performance due to the potential of muscle stiffness and heaviness that can be associated with carbohydrate loading.

Why carbohydrate loading

As mentioned earlier, muscle glycogen is the main source of energy in intense endurance events. As that glycogen is used up, athletic performance is jeopardized. However, the greater the amount of stored muscle glycogen, the greater the endurance potential of the body.

What, when and how of carbohydrate loading

As carbohydrate loading received more attention for its ability to improve athletic performance in endurance events, more research has focused on effective methods.

- The traditional method consists of tapered training accompanied by increased carbohydrate consumption in the weeks leading up to competition.
- A similar method followed this same model but in a shorter duration of time (6 days).
- There are also more rapid methods of carbohydrate loading that seek to maximize glycogen stores in the final 24 hours before competition.

The appropriate method for you depends on the event you are training for, your regimen leading up to the event, and the number of events you plan on participating in throughout the year.

While some athletes may practice a long taper leading up to a major competition, others prefer to keep a high level of training all the way up to the day of the event.

Below are some examples of carbohydrate guidelines according to which method you may choose.

Carbo loading method 1: Long Taper

Using the long taper method, you should have your final hard training session 3 weeks before competition day. By 2 weeks out, you should really start tapering your training.

During this taper time you do not need to eat extra calories since your body will not be using as many as it needed during training. Instead, you should continue to eat 3-5 grams of carbohydrate per pound of body weight and reduce your fat intake to make up for your body's reduced demand for energy.

Your muscles will use these extra carbohydrate calories to build up a glycogen store that will remain, since you won't be using it for training any longer. Normally your body can store glycogen at the capacity of 80-120 mmol/kg.

When practiced perfectly, this method of carbohydrate loading should allow you to almost double that storage capacity to approximately 200 mmol/kg.

Carbo loading method 2: 6-day Protocol

In this method, a glycogen-depleting exercise is performed 6 days prior to the event. This exercise should utilize the same muscle groups that will be used in competition so if you are planning on running a marathon, you would want to do few minutes of very intense sprinting to deplete your muscle glycogen stores.

The next 3 days would consist of a normal mixed diet (~2-3 grams of carbohydrate per pound), and tapered training. Then 3 days before competition you would further reduce training or rest completely and consume a high-carbohydrate (~4.5 grams per pound), low-fat diet.

Carbo loading method 3: Rapid Loading

This method doesn't require the athlete to taper in the weeks leading up to competition. Perhaps this athlete has more competitions to be prepared for soon after, hasn't done enough training leading into competition and needs those last few weeks, or simply performs better physically and/or mentally without a taper.

Whatever the reason, it is possible to achieve comparable glycogen storage results using a 24-hour carbohydrate loading method.

To do this, the athlete will perform an intense glycogen-depleting exercise 24 hours prior to competition. Immediately following this workout the athlete will start to consume a high-carbohydrate diet consisting of 5-6 grams of carbohydrate per pound and continue this throughout the day.

As an example, an athlete weighing 150 pounds would need to eat about 750 grams (or 3000 calories worth) of carbohydrate. To make room for all of these carbs you would need to greatly reduce your intake of fat and protein for that day.

Final tips for carbohydrate loading

Whatever method you choose, there are some things to keep in mind.

- First, as always with any dietary changes, try out carbohydrate loading methods BEFORE you use them in competition. Especially with the rapid loading method, intestinal problems may occur and you do not want to have to deal with these on race day.
- In the weeks and days leading up to competition, continue to eat an adequate amount of protein (0.6-0.7 grams per pound). Protein may be helpful in assisting glycogen synthesis and can also be used as a secondary fuel source in endurance exercise.
- Add some fiber-rich foods to promote regular bowel movements but don't go overboard. Too many refined carbohydrates can result in constipation but too much fiber could cause diarrhea and intestinal distress on race day.
- Expect some weight gain (~2-4 pounds). For every ounce of glycogen the body also stores 3 ounces of water. Although your muscles may feel a little heavier at the beginning of the race these feelings will subside as the body uses up the glycogen and water throughout the race.
- Use various forms of carbohydrate-dense foods and drinks to meet your needs such as juices, gels, and sports drinks. Be sure to consume whole-grain sources as well to balance out all that sugar.
- Do not wait until your last meal to load up on the carbohydrates. You want to give your body time to digest and a big meal at night may leave you feeling full and uncomfortable in the morning. Instead trying eating your largest meal early in the day prior to competition.
- Finally, be sure to still consume some energy sources and fluids during your event. What you have stored up will help you go longer, but it still may not be enough to get you through the entire race without an additional fueling plan.

6 Nutrition Tips for the Perfect Marathon Taper

After miles upon miles and hours upon hours, you have finally reached the tapering phase of your marathon training program.

For some runners, this phase comes with relief; they find themselves with a little more time on their hands when they would normally be running. For others, due to the change in their schedules and eating habits, this phase is more stressful than running all the miles.

The marathon taper requires an incredible amount of discipline; even though the physical challenges of the training program are over, the mental and emotional challenges are only starting to take hold. Here are some tips to help you get through your next marathon tapering phase stress-free and to be nutritionally ready for your next big event.

Tip # 1: Listen to your body

During the tapering phase, although you will not need to continue eating the extra calories that were required when your mileage was at its highest point, building up glycogen stores in your muscles and allowing muscle fibers to require energy.

In order to eat enough to heal muscle fibers and store needed glycogen, but not put on more than the normal 2-4 pounds of weight gain during a taper, I suggest listening to your body. Eat when you are hungry; don't eat just because you have a habit of eating at that time. During your training, you may have unconsciously grabbed a snack an hour before your upcoming run. However, during tapering, that 9-mile run may only be 4 miles, and if your body is not telling you that you are hungry, that snack is not necessary.

On the other hand, if you find yourself hungrier than you expected during tapering, don't ignore the hunger pains. Go ahead and eat a healthy meal or snack because your body is trying to recover and repair itself.

Tip # 2: Don't be worried about light weight gain

Weigh yourself at the beginning of your tapering phase and every few days after that. You know you have tapered well if you gain between 2-4 pounds from the beginning of your tapering phase to event day. Don't panic about these extra pounds.

Your body will use the extra glycogen during your race for energy, and the extra three ounces of water per stored glycogen ounce will help prevent or delay dehydration.

Tip # 3: Add complex carbohydrates, not empty calories

You can get the recommended 3-5 grams of carbohydrates per one pound of body weight without the extra, empty calories. Here are some helpful examples of healthy switches you can make:

- If you usually have toast with peanut butter in the morning, replace your peanut butter with a natural, all-fruit jelly or cut up fresh fruit.

- If you typically enjoy a wrap, soup, or salad for lunch, go with a full sandwich on a whole-grain bread.

- For dinner, try an extra large sweet potato and cinnamon over a smaller white potato with butter.

While tapering, choose higher complex carbohydrate foods when you typically eat a meal instead of adding extra calories during the day.

Tip # 4: Eat protein

Even though carbohydrates are the focus during tapering, protein can't be forgotten. Protein is a dynamic part of the healing and preparation process of the muscles for race day.

I suggest that you strive for 2-4 small servings of protein a day.

Tip # 5: Hydrate, hydrate, hydrate

Drinking water seems to be a struggle for a number of runners I have talked with. Being fully hydrated on race day will help prevent you from bonking from dehydration two-thirds of the way through the race.

During the tapering phase, reducing your consumption of alcoholic beverages will make it easier for your body to rehydrate.

One word of warning—there is no need to over-hydrate. More is not necessarily better when it comes to hydrating because you can throw off your electrolyte balance.

Tip # 6: Plan ahead

Super carbohydrate loading the night before the race, to top off glycogen storage, has been a tradition for many runners. Beware that unfortunately that last boost of carbohydrates does not actually get to the glycogen stores by the time the race starts and could leave you feeling bloated or "heavy" on the morning of race day.

As long as you have been diligent through your tapering phase, your glycogen stores will be fully loaded the day before the race.

The marathon taper can be an incredibly challenging phase during a training plan. Nerves are starting to flutter, you feel like you are losing the fitness you have worked so hard to achieve, and you can't decided if you should eat this or that!

Apply these six nutrition tips to your next tapering phase and rest assured, knowing you are going into race day with your muscles recovered, glycogen stores full, and food fully digested and ready to be used to support a healthy, successful race!

Pre Race Marathon Nutrition

The most common question I get from both beginner and veteran marathoners alike is: "What should I eat during the week and the morning of the Marathon race?"

It's a great question and a very important part of success on race day.

Marathon Rule #1: Never try anything new on Race Day

In addition to clothing, pacing, and training, this rule also applies to your nutrition strategy in the five days leading up to the race. You should not experiment with any new foods or venture too far from your normal diet.

It's easy to get nervous in the last few days of your taper and be persuaded by a new product a friend recommends or something you see at the race expo. However, if you haven't tried it before, especially at marathon pace or during a long run, don't be tempted.

It's also important that you experiment with the types, quantity, and timing of the food you eat before you run.

Some runners have very weak stomachs and need up to three hours to digest food before they can run comfortably. Other runners can eat within an hour of a hard run with no adverse side effects.

It is important to figure out which type of runner you are during training and to take this information into account when you plan for the race morning.

Experiment with your pre-race meal before race day. Your last two long runs or difficult marathon-paced workouts should be similar to race simulations.

Try wearing the clothes you think you'll wear on race day, the shoes, socks, and everything you can think of.

Eat the same pre-race meal you're planning for the night before the race and when you wake up in the morning, eat the same breakfast you plan on having. This will give you time to change things up before race day if you find it doesn't work for you.

5 days from the race

Begin to increase your total carbohydrate intake by adding in more pastas and starches (low-glycemic index foods) to your diet throughout the week. Ensuring that you consume a higher percentage of your total daily calories as carbohydrates is sufficient.

At this point in the nutrition cycle, relax and don't go overboard.

Examples: Sweet potatoes, pastas, baked potatoes, brown rice

48 Hours before the race

Your last big meal should be two nights before the race. It will give your body ample time to digest anything you eat so you won't feel bloated on the morning of the race. I've seen too many people gorge on pasta the night before the race only to reach the starting line the next day stuffed and lethargic. Have you ever tried to run the morning after Thanksgiving? If you have, you know the bloated feeling I'm talking about, and if you haven't, I don't recommend scheduling a tough workout.

Example: The overwhelming favorite is pasta for most people.

24 hours and before

Eat normal balanced meals like you would normally on any training day. Make sure you drink plenty of liquids all day long, especially electrolyte fluids such as Gatorade or use electrolyte tabs such as Nuun. It helps if you carry a water bottle along with you throughout the day to remind yourself to drink.

Your main meals should still be in the form of low glycemic to medium glycemic index foods. Ideally, you won't be too active on the day before the race, so you may feel full quickly. That is fine, you shouldn't try to stuff yourself.

Good choices are: Sweet potatoes, pastas, baked potatoes, brown rice

18 hours before the race

Start eating small meals every 2-3 hours, but after lunch, cut out red meat, fried foods, dairy products, fats, nuts, and roughage. You should only be consuming light, digestible foods like energy bars, bread, and small sandwiches. Keep drinking water and electrolyte beverages and avoid salty foods.

Examples include: energy bars, bread, and small sandwiches. Keep drinking water and electrolyte beverages and avoid salty foods.

4 hours and less

You should be up early enough before the race to eat a small breakfast with plenty of time to start digestion before the gun goes off. If you need 3 hours to eat a small meal before running, then you need to get up at least three hours before the race to get in a light breakfast. You'll want to drink mostly water (unless you know temperatures at the race are going to be warm), with some electrolyte fluid.

Don't try to get all your fluids down by chugging your water bottle. Drink small, regular sized amounts. Room temperature water is absorbed quicker than warm or cold water.

I estimate that you'll need 6 oz. every hour or 8 oz. every hour on hot days.

Lots of runners will take a GU or energy gel right before the gun goes off. I only recommend this if you have a weak stomach and you haven't eaten in 3 hours. If you're able to stomach more solid foods 60-90 minutes before the race, this is preferable. Basically, energy gels are mostly simple sugars and you'll be consuming another 2 or 3 gels before the race is over. Even for the biggest sweet tooth this is a lot of sugar.

My favorite breakfast – oatmeal with banana and coffee. At this point, you should have a good idea of what works best for you pre hard or long run, so stick with what works.

I hope this chapter was a practical and informative nutrition plan you can implement for race day. If you have any questions, don't hesitate to ask.

Part III: Nutrition on race day

The Lowdown on Energy Gels

It wasn't long ago that runners relied solely on water, sports drinks, and maybe some flat cola as their primary carbohydrate supplement during marathons and half marathons. Luckily, our understanding of sports nutrition (specifically how glycogen is used during the marathon) has improved to the point that we now have a plethora of products to choose from, each designed to speed glycogen to our working muscles.

The problem these days is not in finding a glycogen delivery product, but rather in sorting through the myriad of possible choices and then developing a strategic nutrition strategy to ensure optimal fueling on race day.

So, in this article, we're going to outline exactly how energy gels and other carbohydrate supplements work, which will help you understand exactly when and how often you should be taking them to ensure maximum performance and fueling on race day.

How energy gels work

Your body uses two primary sources of fuel to feed the muscles when you're running – fat and carbohydrates. Fat is a largely abundant resource, but is broken down into usable energy slowly, making it an ineffective fuel source when running faster than about 60-70 percent of your VO2max (roughly equivalent to your aerobic threshold or marathon pace).

Therefore, your body relies on carbohydrates as its primary fuel source when racing. Generally, the faster you run, the greater the percentage of fuel will come from carbohydrates.

Typically, we can store about 90 minutes of muscle glycogen when running at half marathon pace and about 2 hours when running at marathon pace.

So, if you're not an elite, you'll be running out of muscle glycogen long before you cross the finish line.

Simply speaking, energy gels are designed to replenish carbohydrate stores that are depleted when running.

Sounds like energy gels are a savior, right? Unfortunately, energy gels don't provide a simple one-to-one replacement (something you won't read on the label of your favorite gel) because the glycogen we ingest from gels doesn't always make its way to the working muscles.

Why?

Because carbohydrates are stored in both the muscles and the blood and your performance on race day relies on using the glycogen stored in the muscle. For glycogen to make its way to the muscles, it must first be digested, make it's way through the intestinal wall, and then absorbed by the muscles. This process takes time and isn't very efficient.

However, gels will often "wake you up" in a very noticeable way because our brain only runs on the glucose stored in the blood. As the muscles start to absorb more blood glucose, the brain gets less glucose and starts to get hazy (you've probably noticed this feeling on your long runs or if you ran without eating enough). Often, a gel will wake you up and help the mind feel energized, but it doesn't necessarily prevent the bonk in your legs.

In summary, energy gels help replenish the glycogen and calories you're burning when racing hard. However, they aren't very efficient or a simple one-to-one replacement, so timing and frequency are critical factors to avoiding the bonk.

When you should take energy gels

Just like almost every facet of running, the timing of when you should take your gels is individual. Each runner absorbs and processes carbohydrates at a different rate – some can feel the effect within three minutes while others might take up to 15 minutes.

This variation in absorption rate has to do with how well your stomach reacts to the gel. When running hard, sometimes, your body shuts the stomach down completely while other times it just slows down. This is why it isn't uncommon to see runners throw up fluids or gels right after ingesting them late into the race.

Therefore, you want to begin taking gels relatively early into the race. By taking the gels early, your body shouldn't be under great duress and you have a better chance of processing the sugars faster and without stomach issues.

I suggest taking your first gel somewhere between 45-60 minutes, depending on how well you generally react to gels in training.

Some runners like to take a gel right before the gun goes off. While there is no problem with this from a physiological standpoint, I find it better to consume a more substantial breakfast, with less simple sugars. This helps you avoid eating nothing but simple sugar for 3-4 hours.

How often should you take energy gels

As we've already discussed, the speed at which you're able to digest and process energy gels plays an important roll in how often you want to take them.

Because the digestion process will be slowed or halted the further you get into the race, you need to be careful not to overload your stomach. Therefore, I suggest waiting about 45-60 minutes between gels before taking another one. Most runners should be closer to the 60 minute mark, especially if they have sensitive stomachs.

The second reason to wait 45-60 minutes between taking gels is that you don't want to speed too much simple sugar into your blood stream at once. Remember, the simple sugars from the energy gels will first be absorbed into your blood stream as glucose. The sugar will stay in the blood stream until absorbed by the working muscles or other organs. If you continue to pump sugar into the blood stream, you'll suffer the same fate as your children if left alone with their bounty on Halloween – sick from too much sugar.

The other aspect to keep in mind is that your digestive track is trainable like most every other part of your body. So if you eat gels in training, particularly if you do it at set intervals that correlate to when you will take them during the race, your body will learn to keep the digestive track running and you will digest the gel more readily. This is why it's critical you practice your exact fueling strategy as often as possible in training.

General tips about energy gels

Now that we've covered some of the basics of how energy gels work and how to properly strategize a marathon or half marathon nutrition plan, we'll cover some practical tips that can help you execute on race day.

How to take if you have problems

Like we've discussed, it's possible that your stomach might shutdown during the latter half of the race.

If this happens to you and you've been unable to take energy gels, try eating only a small portion of the gel, but in closer intervals. For example, eat 1/4 of the packet every 20 minutes. You'll still consume the energy you need, but you'll give your stomach a better chance to properly digest without getting sick.

Always take with water

Always take energy gels with water, never alone and never with Gatorade. Without water, energy gels will take longer to digest and enter the blood stream.

If you take an energy gel with a sports drink, you run the risk of ingesting too much simple sugar at once. Taken together, a gel and sports drink could be delivering close to 60 grams of pure sugar – yack.

Test out flavors and brands

As discussed earlier, not all energy gels are the same.

Some are more viscous, some taste better, and each flavor can be alternately delicious or wretched depending on the runner. The important thing is that you have to experiment and find one that works.

At the 2008 Olympic Trials, Desi Davilla had trouble keeping down her fluids and gels. Everything she took in came back up. So, after fading to the finish, Desi implemented gels in practice, but even that process wasn't smooth.

During long workouts, Davila would force herself to drink and eat gels, but her system still rejected it. In her own words: "It was actually kind of disgusting." However, knowing she could never make the podium if she didn't figure out the issue, Desi continued to force her body to adapt. E

ventually she found the right combination of gels and fluids to train her stomach to handle the sugars and she went on to run 2:22 in Boston.

Next time you think "I just can't do it," imagine what an Olympian (fingers crossed) would say to that.

I hope you've enjoyed the in-depth look at energy gels.

Which Energy Gel is Best for You?

How many times have you found yourself reading the ingredients label of different energy gels trying to determine which might be the best energy gel, only to get mixed up and frustrated, and not able to decide which gel might work the best for you?

Each company that sells sports nutrition products has its own marketing argument as to why their gel is the best one available. You may read statements such as:

- "Contains 4x as much sodium as the leading competitors"
- "Provides more energy to muscles…"
- "Scientifically Proven"
- "Wholesome Ingredients" etc.

It's no wonder deciding which nutritional gel is best for you can be very confusing!

I have no intention of suggesting one gel over another since each person's reaction to a particular gel is different. Some runners need gels that are gluten-free, or they sweat more and thus need more electrolytes.

I simply want to supply you with a list of nutritional facts from gel products that only use natural ingredients in their products. No marketing propaganda aloud, just hard cold facts.

This will allow you to compare gels straight across the board and make an educated decision about the gel product that you would like to use on your runs. You can use this list for several valuable purposes:

- Check different gels for ingredients you may be allergic to or sensitive to. Analyze gels for ingredients that may upset your stomach while running, or that you simply choose not to consume.

- Compare electrolyte amounts; which will help you decide if you want to get your electrolytes and energy in one form or if you need to plan to carry a separate electrolyte source?

- Compare added nutrients such as vitamins, minerals, amino acids, or caffeine.

Ingredients in common energy gels

Brand: PowerBar

PowerBar Gel Vanilla (0mg Caffeine)
Nutrition Facts
Calories: 110, Fat 0g (0%), Sodium 200mg (8%), Potassium 20mg (1%), Total Carbs 27g (9%), Sugar 10 g, Protein 0 g
Ingredients
C2 Max Carbohydrate Blend (Maltodextrin, Fructose), Water, PowerBar Electrolyte Blend (Sodium Chloride, Sodium Citrate, Potassium Chloride), Natural Flavor, Citric Acid, Sodium Benzoate and Potassium Sorbate (to maintain freshness)

Other flavors: Raspberry Cream, Plain

PowerBar Gel Strawberry Banana (25mg Caffeine)
Nutrition Facts
Calories: 110, Fat 0g (0%), Sodium 200mg (8%), Potassium 20mg (1%), Total Carbs 27g (9%), Sugar 10 g, Protein 0 g
Ingredients
C2 Max Carbohydrate Blend (Maltodextrin, Fructose), Water, PowerBar Electrolyte Blend (Sodium Chloride, Sodium Citrate, Potassium Chloride), Citric Acid, Natural Flavor, Green Tea Extract and Caffeine from Tea, Sodium Benzoate and Potassium Sorbate (to maintain freshness) MADE ON EQUIPMENT THAT ALSO PROCESSES MILK AND SOY.

Other Flavors: Green Apple, Chocolate

PowerBar Gel Tangerine (50mg)
Nutrition Facts
Calories: 110, Fat 0g (0%), Sodium 200mg (8%), Potassium 20mg (1%), Total Carbs 27g (9%), Sugar 10 g, Protein 0 g
Ingredients C2 Max Carbohydrate Blend (Maltodextrin, Fructose), Water, PowerBar Electrolyte Blend (Sodium Chloride, Sodium Citrate, Potassium Chloride), Citric Acid, Natural Flavor, Green Tea Extract and Caffeine from Tea, Sodium Benzoate and Potassium Sorbate (to maintain freshness)

Other Flavors: Double Latte

Brand: Gu Energy

GU Energy Gel Peppermint Stick
Nutrition Facts
Calories: 100, Fat 0g (0%), Sodium 50mg (2%), Potassium 40mg (1%), Total Carbs 25g (9%), Sugar 5 g, Protein 0 g, Vitamin C 100%, Vitamin E 100%, Calcium 2%
Ingredients
Maltodextrin (Glucose Polymers), Filtered Water, Fructose, GU Amino Blend (Leucine, Valine, Histidine, Isoleucine), Sodium And Potassium Citrate, Natural Peppermint Extract, GU Antioxidant Blend (Natural Vitamin C And Vitamin E), Citric Acid, Calcium Carbonate, Sea Salt, Contains Preservatives [Sodium Benzoate, Potassium Sorbate], Fumaric Acid, Gu Herbal Blend [Chamomile, Ginger], Pectin.
Gluten-free. Dairy-free. No Caffeine.

Other Flavors: Strawberry Banana, Lemon SubLime, Mint Chocolate, Peanut Butter

GU Energy Gel Mandarin Orange (20mg caffeine)
Nutrition Facts
Ingredients
Maltodextrin (Glucose Polymers), Filtered Water, Fructose, GU Amino Blend (Leucine, Valine, Histidine, Isoleucine), Sodium And Potassium Citrate, GU Antioxidant Blend (Natural Vitamin C And Vitamin E), Citric Acid, Natural Clementine Flavor, Calcium Carbonate, Sea Salt, Contains Preservatives [Sodium Benzoate, Potassium Sorbate], Fumaric Acid, Gu Herbal Blend [Chamomile, Cola Nut (Has Caffeine), Ginger], Oleoresin Paprika (natural color) Pectin.

Other Flavors: Vanilla Bean, Chocolate Outrage, Triberry, Just Plain

GU Energy Gel Espresso Love (40mg caffeine)
Nutrition Facts
Calories: 100, Fat 0g (0%), Sodium 50mg (2%), Potassium 40mg (1%), Total Carbs 25g (9%), Sugar 5 g, Protein 0 g, Vitamin C 100%, Vitamin E 100%, Calcium 2%
Ingredients

Maltodextrin (glucose polymers), Filtered Water, Fructose, GU Amino Blend (Leucine, Valine, Histidine, Isoleucine), Sodium and potassium Citrate, nature coffee flavor, GU Antioxidant Bend (Natural Vitamin C and Vitamin E), Calcium Carbonate, Sea Salt, Citric Acid, Contains preservatives [Sodium Benzoate, Potassium Sorbate], Fumaric acid, malic acid, GU herbal Blend [Chamomile, Cola Nut (Has Caffeine), Ginger], Pectin

Other Flavors: Jet Blackberry,

Gu Roctane Ultra Endurance Gel Blueberry Pomegranate
Nutrition Facts
Calories: 100, Fat 0g (0%), Sodium 125mg (5%), Potassium 55mg (2%), Total Carbs 25g (8%), Sugar 5 g, Protein 0 g, Vitamin E 50%, Calcium 3%, Roctane Amino Blend: histidine, leucine, valine, isoleucine, orthanine alpha-ketoglutarate 480 mg, caffeine 35mg
Ingredients
Maltodextrin (Glucose Polymers), Filtered Water, Fructose, Roctane Amino Blend (Histidine, Leucine, Valine, Isoleucine), Ornithine Alpha-Ketoglutarate (Okg), Sodium Citrate, Malic Acid, Citric Acid, Potassium Citrate, Natural Pomegranate Flavor, Natural Berry Flavor, Calcium Carbonate, Sea Salt, Caffeine, Contains preservatives [Sodium Benzoate, Potassium Sorbate], Natural Vitamin E.
Gluten-free. Dairy-free. 35mg of caffeine

Other Flavors: Vanilla, Orange

Brand: Hammer Nutrition

Hammer Gel Raspberry (0mg Caffeine)
Nutrition Facts
Calories: 80, Fat 0g (0%), Sodium 20mg (1%), Potassium 10mg (Ingredients
Maltodextrin, Filtered Water, Raspberry Puree, Energy Smart® (Fruit Juice, Natural Grain Dextrins), Natural Flavors, Citric Acid, Potassium Sorbate (as a preservative), Salt, Amino Acids (L-Leucine, L-Alanine, L-Valine, L-Isoleucine), Potassium Chloride.

Other Flavors: Apple Cinnamon, Banana, Chocolate, Orange, Vanilla, Unflavored

Hammer Gel Tropical (25mg Caffeine)
Nutrition Facts
Calories: 80, Fat 0g (0%), Sodium 35mg (1%), Potassium 20mg (1%), Total Carbs 21g (7%), Sugar 2 g, Protein 0 g, Alanine 3.3mg, Isolucine 3.3mg, Leucine 6.6mg, Valine 3.3 mg, Caffine 25mg
Ingredients
Maltodextrin, Filtered Water, Pineapple Concentrate, Energy Smart® (Fruit Juice, Natural Grain Dextrins), Natural Flavors, Citric Acid, Salt, Potassium Sorbate (as a preservative), Caffeine, Amino Acids (L-Leucine, L-Alanine, L-Valine, L-Isoleucine), Potassium Chloride.

Other Flavors: None

Hammer Gel Espresso (50mg Caffeine)
Nutrition Facts
Calories: 90, Fat 0g (0%), Sodium 35mg (1%), Potassium 35mg (1%), Total Carbs 22g (7%), Sugar 3 g, Protein 0 g, Alanine 3 mg, Isolucine 1.6 mg, Leucine 6 mg, Valine 3 mg, Caffine 50mg
Ingredients
Maltodextrin, Filtered Water, Energy Smart® (Fruit Juice, Natural Grain Dextrins), Cocoa Powder, Natural Flavor, Coffee Powder, Sodium Acid Sulfate, Salt, Potassium Sorbate (as a preservative), Caffeine, Amino Acids (L-Leucine, L-Alanine, L-Valine, L-Isoleucine), Potassium Chloride.

Other Flavors: None

Brand: Honey Stingers

Honey Stingers Banana
Nutrition Facts
Calories: 120, Fat 0g (0%), Sodium 50mg (2%), Potassium 85mg (2%), Total Carbs 29g (10%), Sugar 29 g, Protein 0 g, Vitamin B 25%

Ingredients
Honey, pure water, potassium citrate, salt, natural flavors, maltodextrin, niacinamide (vitamin B3), calcium panthothenate (vitamin B5), pyridoxine hydrochloride (Vitamin B6), riboflavin (Vitamin B2), thiamine mononitrate (vitamin B1), cyanocobalamin (Vitamin B12)

Other Flavors:Chocolate, Gold, Ginsting (contains ginseng extract), Strawberry,

Vanilla Organic Energy Gel
Nutrition Facts
Calories: 100, Fat 0g (0%), Sodium 50mg (2%), Potassium 50mg (1%), Total Carbs 23g (8%), Sugar 13 g, Protein 0 g, Vitamin B 25%
Ingredients
Organic tapioca syrup, organic honey, water, potassium citrate, natural flavor, citric, acid sodium chloride
Other Flavors: Fruit Smoothie, Acai and Pomegranate

Brand: Clif Bar & Company

Clif Shot Energy Gel Razz (0mg caffeine)
Nutrition Facts
Calories: 100, Fat 0g (0%), Sodium 90mg (4%), Potassium 55mg (2%), Total Carbs 24g

(10%), Sugar 12 g, Protein 0 g
Ingredients
Organic Maltodextrin, Organic Dried Cane Syrup, Water, Raspberry Juice Concentrate, Sea Salt, Potassium Citrate Citric Acid.

Other Flavors: Vanilla, Chocolate

Clif Shot Energy Gel Strawbery (25mg Caffeine)
Nutrition Facts
Calories: 100, Fat 0g (0%), Sodium 90mg (4%), Potassium 55mg (2%), Total Carbs 24g (10%), Sugar 12 g, Protein 0 g
Ingredients
Organic Maltodextrin, Organic Dried Cane Syrup, Water, Organic Strawberry Concentrate Extract, Sea Salt, Potassium Citrate, Citric Acid, Green Tea Extract (contains caffeine).

Other Flavors: Citrus

Clif Shot Energy Gel Mocha (50mg Caffeine)
Nutrition Facts
Calories: 100, Fat 0g (0%), Sodium 60mg (2%), Potassium 85mg (2%), Total Carbs 24g (10%), Sugar 12 g, Protein 0 g
Ingredients
Organic Maltodextrin, Organic Dried Cane Syrup, Water, Organic Cocoa (processed with alkali), Coffee Extract, Natural Flavor, Sea Salt, Green Tea Extract (contains caffeine), Potassium Citrate.

Other Flavors: None

Clif Shot Energy Gel Chocolate Cherry (100mg Caffeine)
Nutrition Facts
Calories: 110, Fat 1.5g (2%), Sodium 60mg (2%), Potassium 85mg (2%), Total Carbs 22g (7%), Sugar 12 g, Protein 1 g
Ingredients
Organic Dried Cane Syrup, Water, Organic Unsweetened Chocolate, Organic Cherry Juice Concentrate, Green Tea Extract (contains caffeine), Natural Flavor, Potassium Citrate, Sea Salt.

Other Flavor: Espresso

Brand: Vega Performance

Vega Sport Endurance Gel Raspberry
Nutrition Facts

Calories: 100, Fat 1g (2%), Sodium 60mg (2%), Potassium 730mg (21%), Total Carbs 22g (7%), Sugar 17 g, Protein .5 g, Vitamin c 70%, Calcium 25%, Iron 4%
Ingredients
Dates, filtered water, EnergySource (grape juice, natural rice dextrin), sorghum malt, Electrolyte blend (potassium, magnesium, calcium phosphate, sodium chloride, Vitamin C, zinc, copper, selenium, chromium) Coconut oil, citric acid, natural raspberry and strawberry flavors

Other Flavors: Orange Zest

What in the World are Some of Those Ingredients?!

Now that you've had a chance to compare ingredient lists (and you recognize most of the ingredients like, cane sugar, water, chocolate and green tea extract), what about the other ingredients. Maltodextrin, sodium benzoate, potassium sorbate, malic acid and fumaric acid. Should you be consuming these? Are they helpful or harmful to your body? Luckily, that's what we're here for.

Here is a break down of each of those ingredients.

Maltodextrin

Maltodextrin is a polysaccharide (a long carbohydrate molecule) that is used as a food additive. Maltodextrin is easily digestible and absorbed rapidly in the body as glucose. It can be made from any starch, but in the U.S. it is typically made from corn. Maltodextrin can be made from wheat, but is so highly processed that little to no protein remains to cause an allergic reaction if you have a gluten sensitivity or allergy.

With maltodextrin being so readily absorbed, studies are suggesting that a combination of maltodextrin and fructose during exercise is more effective than sugar alone. Does your gel combine maltodextrin with fructose? Or does it use a form of sugar that breaks down to both glucose and fructose, and not just glucose alone? Depending on whether your stomach agrees with these research findings, it's an important ingredient to note.

Pros- easily digestible and absorbed, making it useful on long runs
Cons- Like sugar, consuming too much can cause weight gain. If you have wheat or corn allergy you need to be cautious, and highly processed.

Sodium Benzoate

Sodium Benzoate is a food additive used for preservation. In acidic conditions it is a bacteriostat and fungistat. This means it keeps your gel from growing bacteria or fungus. It is used in food, cosmetics, medicine, and fireworks (the whistling noise of fireworks comes from sodium benzoate).

Pro- Your gel should be free of bacteria or fungus
Con – Sodium Benzoate can be toxic to cats at lower levels than humans (so don't share your gels with your feline friends). When combined with potassium benzoate, benzene is formed, which is a known carcinogen. Some studies are suggesting that Sodium Benzene combined with artificial colors may cause hyperactivity.

Potassium Sorbate (aka Scrobic Acid)

Potassium Sorbate is a food preservative that inhibits mold and yeast from growing. It is also a useful substance for helping to increase the shelf-life of a product.

Pro- No moldy gels! Research implies that it has a long-term safety record.
Con – It can be a skin, eye and respiratory irritant.

Malic Acid

Malic Acid is made by all living organisms which contributes to the sour taste of fruits and is used as a food additive. It is one of the few food additives in the U.S. that is also approved by EU, Australia and New Zealand.

Pro-Adds a nice tart taste to your fruity gels and is considered safe all around the world.
Con- None that I have found.

Fumaric Acid

Fumaric Acid is a chemical that has a fruit-like taste. It is a food additive used to regulate acidity. Fumaric acid is also used in the production of polyester resins, polyhydric alcohols and amordant for dyes.

Pro- "improves" the taste of gels.
Con- Although it is deemed safe world-wide, it is still a chemical and there are other more natural food additives that can accomplish a similar goal.

So which gel is best for you?

The goal of this segment is to provide you with a convenient list of nutrition facts and ingredient lists of a wide variety of brands and flavors of gels.

A vital key to improving your running performance and physical health is nutrition education. Being aware of each ingredient in the sport nutrition products that you consume, and knowing if those ingredients are helping or hindering your body's performance, will keep you healthier and running stronger.

The key to finding the perfect gel is testing, trying, and sampling a wide variety of flavors. Using this ingredients list, pick your favorite and give a few a try. Find the taste you like best and make sure to practice on your long runs before making the gel a part of your race strategy.

How To Eat And Drink During a Marathon

Developing and executing a strategy for ingesting fluids and energy during the marathon is a crucial step towards success on race day.

You can't expect to just wing it and drink and eat when feel like it if you want to run your best. Developing a race fueling strategy takes practice and intelligent planning.

Frequency

Start drinking fluids early. Don't wait until you are thirsty or you're getting hot or dehydrated. If you wait until you're thirsty, dehydration or glycogen depletion may already be starting.

Furthermore, the more distressed your body becomes, the more difficult it is for your digestive system to process all the fluids and energy you take in.

By taking in fluids early in the race – when you're not yet fatigued or stressed – you give your digestive system optimal conditions to get the electrolytes and sugars distributed to the muscles that need them.

Begin by taking fluids at the first aid station available.

Usually the first station comes right around the 5k mark. I suggest ingesting an electrolyte drink with sugar so you can keep your fuel levels topped off. Unless you're taking a GU, I think water is better on you than in you during hot days, so opt for the Gatorade at the first few aid stations.

You should aim to take in 6-10 oz of fluid every 2 to 3 miles. If it is a hot day you'll need to take in a bit more.

So, take a look at the race website of the marathon your running and plot out where each aid station is. This way, you'll know ahead of time which stations will provide you with the Gatorade, water, or GU's you will need.

Remember, you don't have to gulp everything down in 5 seconds; you can take your time and carry the cup with you.

If you hear or feel sloshing in your stomach, you don't have to drink for the next 30 minutes since this usually signals that your stomach is full.

Tips

Walk through the aid stations if you plan on running over 3:45 for the marathon or over 2 hours for the half marathon. If you're planning on being faster or very close to these times you can run through the water stations, but make sure you take the time to get as close to 8oz as possible. If you do plan on running through them you need to practice drinking while running during you training.

If you follow these tips and the information from my other articles you'll go a long way towards ensuring success on race day.

No matter what strategy you decide to implement, make sure that you practice your nutrition plan as often and as specifically as possible during your training.

Be creative and have fun, training and racing a marathon is a great experience.