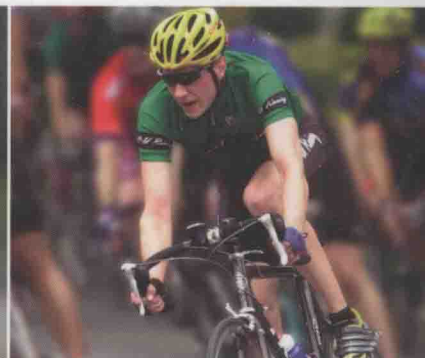




# ***NUTRIENT TIMING for Peak Performance***



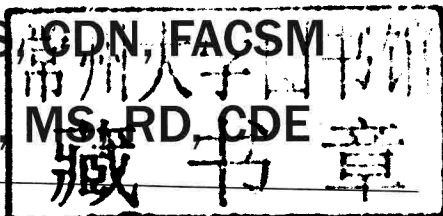
**The right food, the right time,  
the right results**

**Heidi Skolnik, MS, CDN, FACSM  
Andrea Chernus, MS, RD, CDE**

# ***NUTRIENT TIMING for Peak Performance***

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Nutrient timing for peak performance

最佳运动成绩的营养时机



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—Heidi

To Mom and Dad: Thank you for always being in my corner and telling me to keep my eye on the ball. I'm so appreciative of your encouragement, love, and support.

—Andrea

# Preface

“What should I eat before training?” “What’s best to eat after a workout? How soon after should I eat?” “How much protein do I need? When should I eat to maximize muscle building?” “Do I need any supplements during a workout?” “How should my eating change on game day?” As sports nutritionists, these are questions that athletes always ask us. So, when writing this book, we envisioned a comprehensive how-to resource that incorporates the latest research on nutrient timing into easy-to-understand concepts and personalized action plans. We show athletes how taking in nutrients at the right time in regard to exercise, in appropriate amounts, will maximize the results of their training and improve their competitive edge.

Many sports nutrition books on the market focus on one type of sport or are geared more generally toward sports nutrition. Ours is unique. We address a specific aspect of sports nutrition: *timing*. This book looks at the needs of all types of athletes—strength athletes, endurance athletes, and those who participate in stop-and-go sports. We focus on not only *what* to eat but also *when* nutrients have their greatest impact on athletes’ bodies. No other book contains all the concepts presented here in such a hands-on, usable fashion.

Our aim is to help you, the athlete, formulate an eating plan to meet your goals—whether you are male or female; are a professional, college, or high school athlete; or compete seriously, participate for fun, or are training for health, well-being, and aesthetics. Our book can be used by participants of all sports—runners, soccer players, triathletes, cyclists, football players, swimmers, tennis players, fitness enthusiasts, and those who participate in any sport imaginable. Sports nutritionists, coaches, and trainers may also use our book to help their clients and players eat optimally.

Although it’s tempting to start reading the book where we show you how, what, and when to eat, we urge you to start by reading part I, “The Principles.” Why? To benefit from the concepts of nutrient timing, it is helpful to know what nutrient timing is and why it’s important. We’ve always found that when our clients understand *why* we recommend a strategy, they are much more successful at adhering to the plan and reaching their goals. The timing of nutrients can have a big impact on an athlete’s energy. To be ready to practice or compete at your best, you’ll understand why paying attention to when recovery begins will help you restore your capacity for your next hard workout. Did you know that when and how much you eat can help not only with muscle hypertrophy but immune function as well? Additionally, staying well fueled can reduce your risk of injury.

You’ll also learn to set goals for yourself that are reasonable and attainable. You’ll understand what your body is capable of and what is unrealistic to expect for your age, gender, and body type. There is nothing more frustrating than seeing an athlete who is on track and performing wonderfully only to be upset and discouraged because of unrealistic expectations. We want you to be pleased with your results and stay motivated. In part I, we also explain how exercise affects your body—in everyday language. If you understand these concepts, nutrient timing makes more sense.

Building on this base of knowledge, we introduce the players to all the nutrients involved in part II, “The Nutrients.” This part is vitally important because we sort out facts from myths and misperceptions surrounding nutrients. For example, carbohydrate, when eaten at specific times and in specific amounts for your size and energy expenditure, aids in regenerating muscle energy and may help with immune function by freeing up key amino acids; protein ingestion may help push muscle hypertrophy after strength training and may also keep the immune system buzzing; and fat has played a controversial role over the years, but we’ll examine how and when it is used as a fuel. Fat can keep your hormones humming, and taking in enough is vital for making testosterone and estrogen, which play important roles in health *and* performance.

Now that you're well versed on the concepts, we'll apply all the knowledge specifically to you and your sport. Part III, "Fueling Strategies, Plans, and Menus," walks you through setting *your* goals, timing *your* intake for training, and understanding how it may differ for competition. We help you determine which type of nutrient timing plan is appropriate for your sport. We show you how to determine your unique nutrient timing and put it all together into a personalized plan for before, during, and after workouts, practices, games, or matches. We have plenty of charts, examples, and sample meal plans to use as guides. We talk about supplements that may be popular in your sport or activity—do they help, or could they harm?

Nutrient timing takes sports nutrition to a new level. It's a targeted and focused way of utilizing science to optimize the effects of diet on sports performance. Nutrient timing can improve both short-term and long-term recovery from the wear and tear of intense workouts, practices, and games to help athletes stay strong and healthy throughout seasons of play. Appropriate timing of nutrients can also help push the muscle-building effects of strength training and help diminish the muscle breakdown that often occurs with heavy endurance training. Immune function and injury prevention are concerns for all athletes. We show you why what you eat and when you eat can influence both your immune function and your chance of injury. What and when you eat can even affect your hormonal levels, which in turn affect everything from body composition to mood. Finally, we show you samples of plans, foods, and strategies you can implement to improve your nutrient timing and that can help you be the strongest, fastest, healthiest athlete you can be.

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P A R T

I

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# THE PRINCIPLES



# 1

## The Nutrient Timing Advantage

Have you ever felt dead-legged or worn out during practice? Do you lift and lift and lift yet can't seem to put on an ounce of muscle? Are you frequently getting sick or injured? Maybe you feel great and want to perform at an even higher level than you are right now, but you believe something is missing. What you eat, how much you eat, and when you eat can affect your energy, your training, your immune function, and even your risk of injury.

### WHAT IS NUTRIENT TIMING?

Nutrient timing is a strategic approach to how much, what, and when you eat before, during and after training and competition to maximize training effects, reduce risk of injury, maintain healthy immune function, and help with recovery. Nutrient timing is a system of eating meals and snacks in relation to planned exercise. It's a system of working the composition of your food selection, the portions of your food selection, and the timing of intake of your food so that it does the absolute most it possibly can to help your performance. As you read this book, we hope to help you understand how different food components affect your body before, during, and after all types of exercise. Nutrient timing takes advantage of how food influences different chemical reactions inside your body.

Various strategies may be used depending on whether you are cycling, lifting weights, running a marathon or a 100-meter dash; or going to football, baseball, lacrosse, or soccer practices, games, or even tournaments. Nutrient timing helps you understand the principles to fuel your body well—and we give you plenty of examples and tips on planning for real-life athletics.

Essentially, the four most important aspects of sports performance are training, skill development, nutrition, and rest. One cannot make up for another. Training

harder can't make up for a poor diet, and food can't take the place of appropriate rest. An athlete would never show up for practice without the appropriate gear (soccer cleats, baseball glove, hockey puck, lacrosse stick, and so on), so why would an athlete show up to practice or a game without the proper fuel? Athletes who realize that food is an integral part of training can benefit tremendously. Timing your food intake properly can provide

#### **Timing Tip**

Nutrient timing transforms eating into a strategic component of your training, conditioning, and sports performance. By coordinating food intake at the right time with regard to your training, you will be able to take better advantage of the changes in body chemistry that occur with eating and exercise to help with muscle building; to maximize energy storage, which can help generate power and promote endurance; and to facilitate muscle recovery and keep you healthy throughout your training.



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**Whether competing or training for an endurance, stop-and-go, or power and strength sport, following the Nutrient Timing Principles (NTP) can help keep energy consistent.**

sufficient energy, help you recover for your next practice or event, keep you strong and healthy, reduce muscle breakdown, aid in muscle building, and even promote hypertrophy (gaining size, not just strength), as well as reduce the risk of injury.

We also realize that for any nutrition plan to work, it has to be realistic and fit into your lifestyle. Athletes often have challenging schedules, and taking time to eat frequently takes a back seat to all of the other responsibilities in athletes' lives. We know that trying to balance training along with work, school, family, social commitments, and other interests or activities can be difficult. Meals can be missed or skipped, or eating gets delayed. Did you know that if you skip dinner, it can severely impact your training the following day? What you ate yesterday affects the energy you will have at the end of today's workout! Since it takes 24-48 hours to stock and restock the energy your muscles need to get the work done, there is a carry-over from one day to the next in terms of energy level. So many athletes tell us that they never thought of that! Are you aware that when you feel shaky during a run it's a sign of inadequate fueling to your central nervous system – which only runs on carbohydrate?

When there are long gaps without food, appetite and eating can become disconnected. Many athletes ask us why they can't stop eating at night—from recreational to college athletes and even some pros. It often happens when you're under-fueled during the day, and when the opportunity to eat presents itself, it's like a dam broke! And it's not all nutritious food that's consumed. In fact, when appetite runs amuck, most likely the foods consumed are done so more in a constant "grazing style," or with a ferocity that pretty much precludes either true enjoyment or sound decision making. It can become a vicious cycle if you overeat at night, awake still full, skip breakfast, and under-fuel again during the day. Having a plan in place and food available when you need it helps avoid these pitfalls. If

your day is unstructured, put structure into it by planning the timing of meals and snacks. The best strategy for a practical plan that yields results acknowledges these very real time constraints. Our recommendations will keep this in mind. We will help you determine when to eat, what to optimize training and performance, and to understand how to put the science into real-life eating.

## WHAT ARE THE BENEFITS OF NUTRIENT TIMING?

As mentioned earlier, there are several benefits of nutrient timing. These involve maximizing your body's response to exercise and use of nutrients. The Nutrient Timing Principles (NTP) help you do the following:

- Optimize fuel use so that you remain energized throughout your training
- Ensure that you repair and strengthen your muscles to the best of your genetic potential
- Ingest sufficient nutrients to keep you healthy and able to fight off infection, limiting the suppression of the immune system often experienced with intense training
- Recover from your training so that you are ready for your next practice, event, or training session with well-fueled muscles

### Energy

When sports nutritionists talk about energy, we are referring to the potential energy food contains. Calories are potential energy to be used by muscles, tissues, and organs to fuel the task at hand. Much of the food we eat is not burned immediately for energy the minute it's consumed. Rather, our bodies digest, absorb, and prepare it so that it can give us the kind of energy we need, when we need it. We transform this potential energy differently for different tasks. How we convert potential energy into usable energy is based on what needs to get done and how well prepared our bodies are; how we fuel endurance work is different from how we fuel a short, intense run. Chapter 2 discusses the science behind energy, but first it is helpful to understand that you must get the food off your plate and into the right places in your body at the right time.

Clients consistently ask us, "What can I eat to give me energy?" For you, "energy" may have different meanings, depending on what you're referring to and how you're feeling. If you're talking about vitality, liveliness, get-up-and-go, then a number of things effect this: amount of sleep, hydration, medical conditions, medications, attitude, type of foods eaten, conditioning and appropriate rest days, and timing of meals and snacks. Food will help a lack of energy only if the problem is food related. You may think that's obvious, but it's not to some. If you're tired because you haven't slept enough, for instance, eating isn't going to give you energy. However, if your lack of energy is because you've eaten too little, your foods don't have "staying power," you go for too long without eating, or you don't time your meals and snacks ideally around practice or conditioning, then being strategic with food intake can help you feel more energetic. What, how much, and when you eat will affect your energy.

Nutrient timing combined with appropriate training maximizes the availability of the energy source you need to get the job done, helps ensure that you have fuel ready and available when you need it, and improves your energy-burning systems. You may believe that just eating when you are hungry is enough, and in some cases this may be true. But, many times, demands on time interfere with fueling or refueling, and it takes conscious



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### What, how much, and when you eat will affect your energy.

repair and growth that results in gained strength. However, some of the damage is purely negative and needs to be minimized or it will eventually impair health and performance. Providing the right nutrients, in the right amounts, at the right time can minimize this damage and restore energy in time for the next training session or competition.

The enzymes and hormones that help move nutrients into your muscles are most active right after exercise. Providing the appropriate nutrients at this crucial time helps to start the repair process. However, this is only one of the crucial times to help repair. Because of limitations in digestion, some nutrients, such as protein, need to be taken over time rather than *only* right after training, so ingesting protein throughout the day at regular intervals is a much better strategy for the body than ingesting a lot at one meal. Additionally, stored carbohydrate energy (glycogen and glucose) and lost fluids may take time to replace.

By replacing fuel that was burned and providing nutrients to muscle tissue, you can ensure that your body will repair muscle fibers and restore your energy reserves. If you train hard on a daily basis or train more than once a day, good recovery nutrition is absolutely

thought and action to make it happen. Additionally, appetites are thrown off by training, so you may not be hungry right after practice, but by not eating, you are starving while sitting at your desk in class or at work. Many athletes just don't know when and what to eat to optimize their energy stores.

By creating and following your own Nutrition Blueprint, as you will learn how to do in part III, and incorporating the NTP, your energy and hunger will be more manageable and consistent, whether you are training several times a week, daily, participating in two-a-days, or are in the midst of the competitive season.

## Recovery

During the minutes and hours after exercise, your muscles are recovering from the work you just performed. The energy used and damage that occurred during exercise needs to be restored and repaired so that you are able to function at a high level at your next workout. Some of this damage is actually necessary to signal repair and growth, and it is this

vital so that your muscles are well stocked with energy. Most people think of recovery as the time right after exercise, which is partially correct, but how much you take in at subsequent intervals over 24 hours will ultimately determine your body's readiness to train or compete again.

### Timing Tip

The right mix of nutrients taken just after exercise helps muscles recover, but nutrients must be consumed within the context of an overall well-designed training diet to be most effective.

## Muscle Breakdown and Muscle Building

Nutrient timing capitalizes on minimizing muscle tissue breakdown that occurs during and after training and maximizing the muscle repair and building process that occurs afterwards. As you will learn in chapters 3 and 10, carbohydrate stored in muscles fuels weight training and protects against excessive tissue breakdown and soreness. Following training, during recovery, carbohydrate helps initiate hormonal changes that assist muscle building. Consuming protein and carbohydrate after training has been shown to help hypertrophy (adding size to your muscle). The proper amount and mix of nutrients taken at specific times enables your body to utilize them most efficiently—that's one of the Nutrient Timing Principles.

### *Timing Tip*

Eating a small amount of protein, such as poultry, lean meats, fish, eggs, milk, or yogurt, with each meal and snack will help utilize it effectively for muscle building and repair.

## Immunity

Nutrient timing can have a significant impact on immunity for athletes. Strenuous bouts of prolonged exercise have been shown to decrease immune function in athletes. Furthermore, it has been shown that exercising when muscles are depleted or low in carbohydrate stores (glycogen) diminishes the blood levels of many immune cells, allowing for invasion of viruses. In addition, exercising in a carbohydrate-depleted state causes a rise in stress hormones and other inflammatory molecules. The muscles, in need of fuel, also may compete with the immune system for amino acids. When carbohydrate is taken, particularly during longer-duration endurance training (two to three hours), the drop in immune cells is lessened, and the stress hormone and inflammatory markers are suppressed. Carbohydrate intake frees amino acids, allowing their use by the immune system. Carbohydrate intake during endurance training helps preserve immune function and prevent inflammation.

Certain vitamins and minerals also play a role in immunity: iron, zinc, and vitamins A, C, E, B<sub>6</sub>, and B<sub>12</sub>. However, excess intake of iron, zinc, and vitamins A, C, and E can have the opposite effect and in some cases impair the body's adaptation to training. An eating plan incorporating all of these nutrients in reasonable quantities, such as amounts found in food, can help athletes maintain immunity. The quality of the foods selected is very important and needs to be just as much of a priority as the focus on carbohydrate or protein, for example. For instance, eating a bagel for the carbohydrate but also including an orange for the vitamin C is important; drinking a protein shake can be helpful at the right time, but including some lean steak or shellfish for the iron and zinc is also essential.

## Injury Prevention

Did you know that dehydration and low blood sugar can actually increase your risk of injury? Avoiding injury due to poor nutrition is absolutely within your control. Inadequate hydration results in fatigue and lack of concentration. Low blood sugar results in inadequate fueling to the brain and central nervous system. This leads to poor reaction time and slowness. Poor coordination as a result can lead to missteps, inattention, and injury.

Additionally, chronic energy drain (taking in fewer calories and nutrients than needed) will increase your risk of overuse injuries over time. Stress fractures are one example; poor tissue integrity can happen when athletes think solely about calories taken in but not the quality of the calories consumed. This is what is behind the phrase "overfed but



undernourished.” Eating lots of nutrient-poor foods will not provide your body with the building blocks for healthy tissues and overall repair. Inadequate protein will also hinder the rebuilding of damaged muscles during training. If muscles are not completely repaired, they will not be as strong as they could be and will not function optimally. The damaged muscle fibers can lead to soft-tissue injuries. Both protein and carbohydrate along with certain nutrients are needed to help with this repair. For instance, gummy bears may provide carbohydrate, but they don’t contain any vitamin E, which is helpful in repairing soft-tissue damage that occurs daily during training. Therefore, the goal is both an appropriate quantity and an appropriate quality in food selection.

The case for nutrient timing has been made, and hopefully you are onboard. In the following chapters, you’ll learn about the science behind NTP and how they are applied to athletes’ diets by sport. By the end of the book, you’ll have all the tools to create your own Nutrition Blueprint and menu plans. Whether you are training for endurance or competing in a sport requiring strength and power or in which intermittent bursts of activity are important, we will help you create an optimal fueling strategy based on the Nutrient Timing Principles.