

Nutrition Intervention and Race Preparation

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LEARNING OBJECTIVE

This article will provide a thorough, yet general, nutritional workup of and guidelines for a novice runner in preparation for a half marathon. The neo-runner will be led through three stages of nutritional strategies, which include 1) weight loss and improving general nutrition, 2) periodized eating and fueling, and 3) race preparation and recovery.

Key words:

Nutrition, Local Food, Athlete's Plate, Periodized Sport Nutrition, Pre-Event Nutrition

INTRODUCTION

The nutritional plan for this runner will first focus on weight loss in conjunction with improving overall nutritional quality of his diet before emphasizing periodized nutrition and fueling for running performance. The final nutritional approach is to prepare the runner for competition.

The nutritional plan for this case, therefore, includes three phases:

1. Weight loss and general nutrition
2. Periodized eating and fueling
3. Race preparation and recovery

Under ideal circumstances, this runner has a sport science/medicine support group around him to reach his goal. For nutrition, a Certified Specialist in Sports Dietetics (CSSD) would first do a thorough nutrition assessment. A nutrition assessment provides the foundation for developing the nutrition diagnosis and subsequent intervention and monitoring strategies according to the Nutrition Care Process of the Academy of Nutrition and

Dietetics (4). For more information on the nutrition assessment for this hypothetical case, see Sidebar.

From a reference standpoint, a health and fitness professional is an important liaison to the nutrition workup of this case, however, the CSSD is responsible for an effective dietary intervention. Thus, referring this client to a sport dietitian will ensure that evidence-based and best practice models are used to help this client achieve his goals. To find a sport dietitian in your area, see www.scandpg.org. A consult with a CSSD costs approximately \$75 per hour, but a full program may be a \$250 to \$500 investment — well worth the cost! For those interested in “freebees,” many universities have sport nutrition graduate programs and seek interested volunteers to work with their students as a case study. It never hurts to ask. The price tag for this is \$0.00!

PHASE 1: WEIGHT LOSS AND GENERAL NUTRITION

The runner in our case study has to lose weight to reach a half marathon time of less than or equal to 2 hours. Current body mass index (BMI) is 27 kg/m^2 , but ideally, the runner decreases BMI to less than 25 kg/m^2 . Current weight is at 70 kg (154 lbs), and a 5-kg (11-lb) weight loss or more is needed to decrease his BMI to 25 kg/m^2 . To reduce the risk



of injury, especially early during his training plan, phase 1 of the nutritional intervention aims for weight loss through better eating. This will enhance many aspects of training, including the perception of effort. To achieve a weight loss (fat loss) of 1 lb or approximately 0.5 kg per week, an energy deficit of 3,500 kcal is needed. This can be achieved with a 500-kcal deficit each day except when training intensity starts to increase at which time weight loss is no longer the priority.

The first focus is to develop a simple meal plan for this client that helps with changing a typical American diet to a healthier alternative. It will be critical to provide simple approaches that the neo-runner can put into place around his busy work schedule but also to teach him the needed skills to become more self-sufficient and literate regarding good food.

Although a decrease in caloric intake is most important, we also want to preserve muscle mass of the runner. Thus, the first

approach is to develop a meal plan that reduces total caloric intake but maintains his already high protein intake at 2 g/kg (~1 g/lb) body weight per day. Research shows that hypocaloric diets are best matched with higher protein intakes if lean body mass is to be maintained or increased while losing weight (6). Carbohydrates are kept at 3 g/kg (1.4 g/lb) body weight per day on nontraining/resting days and are increased to 5 g/kg/ (2.3 g/lb) body weight for moderate training days (2). Fat intake is kept low to help with fat loss. Eating foods lower in fat precludes this runner from eating fast food unless delis and cafés are identified carefully where healthier fare is available (*e.g.*, Chipotle).

The Table shows current hypothetical dietary patterns (based on the nutrition assessment), goals for weight loss, and enhancing diet quality, followed by recommendations for change.

Successful weight loss and weight loss maintenance depend on many factors, but exercise, consistent healthful eating

TABLE: Healthier Food Options for a Neo-Runner in the First Phase of Training

Category	Current Intake	Goal	Recommended
Grains, potatoes, breads, cereals	French fries, white rice, pasta, white bread, potatoes, breakfast cereals	Increase whole grain consumption and replace processed carbohydrates with whole grain options	Whole grain crackers, sweet potatoes, beets and other root vegetables, brown and wild rice, whole grain bread, whole grains such as spelt, emmer, einkorn (Ancient grains), organic granola, 9-grain muesli, oatmeal, beans, and lentils
Vegetables	Broccoli, carrots, iceberg lettuce	Increase variety of produce and purchase at farmer's market for highest nutrient content, best flavor, and community connection	Seasonal vegetables according to a seasonal calendar, see http://eatseasonably.co.uk/what-to-eat-now/calendar/ , or any other seasonal produce calendar related to the local environment
Fruit	Bananas, frozen berries	Increase variety of produce and purchase at farmer's market for highest nutrient content, best flavor, and community connection	Seasonal fruit according to a seasonal calendar, see http://eatseasonably.co.uk/what-to-eat-now/calendar/ , or any other seasonal produce calendar related to the local environment
Protein	Chicken, beef, shrimp	Increase variety of protein options and source sustainably to obtain better quality and safe food	Free range, organic poultry, eggs, pasture (grass-fed)-raised dairy products and meat, some vegetarian options
Fats	Fast food, American cheese, Thousand Island dressing	Reduce the number of fast food meals; reduce amount of cheese and replace by more flavorful options; reduce amount of dressing and replace with healthier choices	Identify healthier fast food dining establishments with more sustainable, whole food options (<i>e.g.</i> , Chipotle); learn about Artisan cheeses and replace current high intake with smaller more flavorful amounts; and add simple dressings with olive oil and vinegar to salads
Sweet snacks	Cookies, ice cream, cream pies	Reduce processed desserts and replace with more wholesome options	Dried and fresh fruit, fruit yogurts, sorbet mixed with Greek-style yogurt and fruit, some dark chocolate
Savory snacks	Chips, crackers, popcorn with butter	Reduce processed snacks and replace with more wholesome options	Whole wheat pita with hummus, baked tortilla chips with salsa, raw or roasted nuts with curry, apples, and raisins
Flavors	Salt, hot sauce, catsup, BBQ sauce	Reduce salt and sugar-laden sauces	Include olive oil, butter, salt, pepper, garlic, onion, fresh and dried herbs, spices such as curry and chipotle, salsas, etc.
Fluids	Coffee, soda, beer, some water	Avoid soda and moderate alcohol and coffee intake; increase water consumption	Avoid soda and limit alcohol and coffee consumption to 1 to 2 per day; increase water intake during the day and before, during, and after exercise

starting with breakfast, and monitoring body weight are all important (8). Checking in with a trainer or CSSD and using an online app such as “My Fitness Pal” are great ways to engage the runner and, at the same time, make the runner accountable.

Although meal plans may be convenient and easy on paper, people are not good in following strict dietary guidelines. Recommendations based on educational tools, such as the Athlete’s Plate (7), often resonate better with clients than rigid dietary plans. Based on the Plate model, the Healthy Plate is built on fresh seasonal produce with a good portion of protein and a handful of whole grains or starchy carbs such as sweet potatoes with some fresh fruit. This Plate is for a rest or easy training day, which applies for the first phase of this runner’s marathon training. Eating according to the Healthy Plate should help induce weight loss and improve the nutritional quality of this runner’s eating practices. They are encouraged to work with a sport dietitian and go on a “how to shop for good food” tour at a local grocery store. The visits also should include local farmer’s markets to gain an understanding of seasonally available food and taste the difference between a market tomato and a regular one. The sport dietitian can introduce cooking skills and provide a workshop and event calendar for cooking classes in the community. Cooking workshops, integrating fresh ingredients, can be a nice way to make new friends in a fun and playful environment called the kitchen!

A critical component of the dietary intervention is to abandon soda consumption because it contributes a significant amount of calories, however, does not help with keeping a check on caloric consumption (3). The nutritional plan also should limit processed foods because they are linked to obesity and diabetes and will make weight loss more difficult. In addition, lunches should be supported by a healthy restaurant map where the runner can get fresh salads, soups, and sandwiches loaded with veggies on whole grain bread or open-faced and where chips are exchanged for fresh seasonal fruit, thereby reducing energy density along the concepts of volumetrics (10). Although eating foods with a lower energy density is key to achieve early weight loss, as training gets harder, some changes are needed to prepare for and recover from intense training (see plates in 7).

To maintain a consistent flow of healthful eating patterns through the day, our neo-runner also needs to learn to bring good snacks to work (Table), and based on our hypothetical assessment, the runner eats relatively few fruits and vegetables. Thus, the recommendations will be straightforward! We also want to ensure adequate amounts of protein throughout the day, including at snack times. Thus, fresh veggies are combined with hummus and fresh fruit with yogurt. The extra protein will provide satiety and stimulate metabolism. There should be a morning and afternoon snack, but the neo-runner also needs to

be guided by physical hunger and should continue his work effectively without the distraction of eating by the computer. In fact, when eating, the best recommendation is to move somewhere else — best outside or to a table or chair without the phone and other devices and to slow down, savoring good food in a mindful way. Eating in the car and in front of the computer or TV are “out,” and eating with friends and in a nice setting in the park are “in.” Healthy behavior change lays the foundation for sports performance! “You must be healthy before you can get fit.” Mindful eating will help with respect to weight loss, and eating when hungry, slowing down at the table, and stopping when comfortably full, or before, are all good approaches that may help in sustained behavior change!

PHASE 2: NUTRITION PERIODIZATION

As the runner loses weight and increases exercise volume and intensity, nutrition periodization and learning how to adapt eating to the training plan become of great importance and also are the next steps to increase knowledge and skill from phase 1. Assuming that the runner has become self-sufficient to prepare three to five meals in the kitchen, has a refreshed approach to lunch, knows where to source food seasonally and locally, and has made some friends with whom to share food and his marathon journey, it is now time to teach the essentials of sport nutrition.

1. Adjusting energy and carbohydrates to training volume and intensity
2. Hydrating according to daily fluid needs and sweat rate during exercise
3. Fueling before running
4. Using sport nutrition products during running
5. Recovering from back-to-back hard training days
6. Staying healthy with good nutrition

The International Olympic Committee recommends to adjust carbohydrates based on intensity and volume of training (2). As mentioned before, we have set targets for rest and easy training days. These relative carbohydrate recommendations increase as training intensity and volume increase; however, our neo-runner is not an elite athlete — this runner is starting out, and while he needs to support his training with moderate carbohydrate amounts and topping these off for racing, the approach does not need a push for extra pasta and garlic bread but rather choosing carbohydrate sources and amounts wisely when training matters and recovery time is limited (*e.g.*, back-to-back harder training days and days where runs are longer or interval training is inserted).

Although numbers help us as sport nutrition professionals to do the math, we really don’t need to communicate any of these to the runner. What the runner needs are simple guidelines, such as the Athlete’s Plate, to understand how to eat as training intensifies. A relatively loose meal plan will teach more details and can provide portion sizes. Finally, timing for food intake before exercise also is critical and can be inserted into a meal



plan. If training occurs in the morning, breakfast should be eaten at least 1 to 2 hours before. For easy runs, saving breakfast for after the run also is a good strategy — provided that the run is short and easy. Lunch should be ingested 2 to 3 hours before running, but the harder the workout, the more digestion time may be needed. As previously shown by Meyer *et al.* (7), the Fitness and Performance Plates contain more carbohydrates and there is a gradual decrease in vegetables (especially raw veggies) to decrease bloating and gastrointestinal (GI) distress. Rather than eating salads at lunch for a harder workout, this is the time to switch to a simple sandwich or a rice bowl instead. Meals with beans or high-fiber ingredients also are discouraged close to workouts, as is fast food composed of fried foods. Fat is hard to digest, and the shorter the digestion time, the leaner the meal should be.

The next step of nutrition periodization is to introduce fueling during training, and because the expected half marathon time is approximately 2 hours, it is critical to aim for proper fueling to avoid running out of carbohydrates, or in layman's terms, "hit the wall"! Thus, the neo-runner needs to begin to test some of the sport nutrition products on the market but, at the same time, keep things simple. For the half marathon and to support longer runs, they should begin to use a sport drink. However, to know how to develop the fueling puzzle, we first need to know his sweat rate.

To measure sweat rate, our neo-runner needs to measure his pretraining weight, followed by the posttraining weight. Let's

say he loses 1 lb during a 1-hour run. His sweat rate is 16 oz or 2 cups (1 lb = 16 oz or 500 mL). For this sweat rate, about 30 g of carbohydrates can be ingested from a sport drink per hour of exercise if 100% of fluid lost is replaced (at a 6% carbohydrate concentration, 16 oz or 500 mL of sport drink will contain 30 g of carbohydrates). In most active individuals, however, a 100% sweat loss replacement through fluid intake is not accomplished. Thus, it is safe to say that our neo-runner will replace approximately 80%, and this should suffice to maintain fluid balance and prevent dehydration at a level greater than 2%. Sweat rate increases with training, environmental conditions (especially heat and humidity), and with exercise intensity (1). Thus, estimating it once will not be enough to plan for fluid replacement during the half marathon. Sweat rates should be reassessed throughout the training period, and when to do this is best determined by the coach and the sport dietitian. Besides replacing fluid according to sweat rate and replenishing what was lost with a carbohydrate sport drink, additional carbohydrates can boost performance (5) and reduce the risk of hitting the wall or experiencing a gradual fall in blood glucose levels and early onset of fatigue. Thus, for the longer training runs, our case study should trial ingesting gels or blocs/chews or bits of a sport bar. One extra gel, three blocs/chews, or half a bar would add approximately 25 g of carbohydrates during the run and would be enough to help maintain performance throughout the race. Not all sport nutrition products are created equal, however, and GI distress in runners is extremely common (12). To reduce the risk of GI upset during the race, the gut must be trained, and this is an important part of the fieldwork, while training at faster near-marathon pace to set up our neo-runner for success!

Finally, as training volume and intensity increase, we want to ensure quick recovery from day to day, especially when training sessions are back-to-back. Adequate recovery for our neo-runner includes an immediate recovery snack and plenty of fluids. Considering the removal of soda and general lack of fruit and veggies, smoothies made fresh from seasonally and locally grown fruit with fresh yogurt and local honey would not only meet recovery needs but also add nutrients to his overall diet. Of course, items such as low-fat chocolate milk or a sport bar and sport drink after intense training sessions (interval) and long runs would be adequate too. For easier training sessions, a regular meal will serve as recovery food. In summary, recovery nutrition includes adequate fluids (about $1.5\times$ as much as what was lost (11)), carbohydrates (1g/kg per hour or ~ 0.5 g/lb per hour (2)), and about 20 to 25 g of protein after exercise (9).

As our neo-runner gets more skilled and intuitive with eating for health, weight control, and fitness, he also is acquiring the needed fueling strategies for eating and drinking before, during, and after exercise and should be able to discern among the various training blocks and his energy demands. The final step toward the half marathon countdown then is race preparation.

PHASE 3: RACE PREPARATION

Race preparation typically is divided into eating in the days before the race while tapering, a pre-event meal such as breakfast, a pre-event snack/fluids, and fueling during the event.

Carbohydrate loading is recommended for events longer than 90 to 120 minutes because glycogen depletion could be a factor limiting performance (2). Especially in novice athletes, carbohydrate loading can be of great benefit. For our neo-runner, this would mean to ingest approximately 10 g of carbohydrate per kilogram (4.5 g/lb) of body weight for 3 days before the event. This equals approximately 650 g of carbohydrate per day while exercise is tapered. Many people, especially females, have a hard time pushing themselves to eat that many carbohydrates but there certainly are some tricks that can help accomplish a high carbohydrate intake:

1. Select carbohydrate sources that are lower in fiber such as white rice, white pasta, potatoes, lighter wheat bread, oatmeal, or a favorite sugary cereal (really the only time this is recommended)
2. Add some sweets that also are low in fat such as fruit sorbet, juices, fresh, dried, pureed fruit (apple sauce), honey, and jam. Keep vegetables cooked such as pureed veggie soups, steamed carrots, root vegetables, pumpkin and winter squash, and zucchini but avoid raw vegetables and cabbages
3. Eat frequently throughout the day (every 2 hours)
4. Balance meals with moderate protein
5. Focus on foods low in fat
6. Do not weigh yourself (you will gain weight but it's water!)

The last meal before the event is a critical time to top off glycogen stores, and this usually is the race breakfast, ingested 3 to 4 hours before race start. Best is to eat the same breakfast during the loading phase and occasionally in preparation for high-intensity or long-duration training runs so the GI tract can

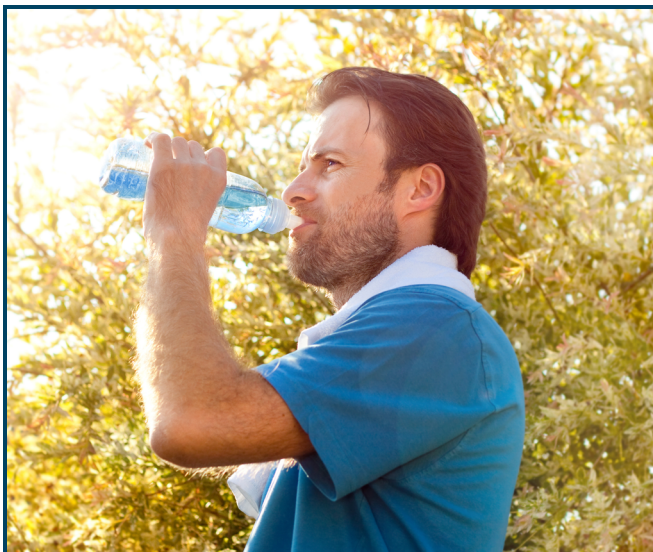
get used to it. The pre-event meal should be low in fiber, high in carbohydrate (1 to 4 g/kg [0.5 to 2 g/lb] body weight), moderate in protein, and low in fat. Examples include oatmeal with bananas and extra honey, a few eggs, sport drink or coffee, followed by a small snack (gel or sport drink) 30 to 60 minutes before the event start. The American College of Sports Medicine recommends 5 to 7 mL of fluid per kilogram of body weight (~10 to 16 oz for our athlete) 3 to 4 hours before, with extra fluids before race start, especially if urine is dark (1). The snack 30 to 60 minutes before is optional, but drinking a sport drink before race start over water is one way to reduce diuresis and the number of times our athlete may need to hit the bathroom.

During the race, as trialed in training, our runner needs to get into a good routine of fluid replacement using a sport drink. To optimize carbohydrate availability, an additional 25 to 30 g of carbohydrates per hour should be added to target approximately 60 g of carbohydrate per hour of running (sport drink + gel) (5).

Finally, maintaining proper fluid balance is extremely important for our novice runner. A way to ensure good hydration status throughout the training program and leading up to the race is to check urine color. A slight yellow hue provides good assurance that hydration needs are met. Dark-colored urine indicates dehydration, and this should only be the case for a few hours after exercise. The aim is to return urine color to light yellow and to start the day and most training sessions with good hydration status.

In summary, our novice runner is led through stages of nutrition assessment, ensuring he meets basic nutritional needs. He learns about weight loss using concepts of energy density through boosting vegetable, fruit, and whole grain intake and cutting processed foods, fried food, and soda. He is given visual tools, such as the Athlete's Plate, and assistance to adjust portion size and eat more mindfully. He gains skills for shopping and cooking, thereby meeting a community of active friends at the market and in the kitchen. The next phase of the sport nutrition journey includes periodized nutrition, where he learns how to adapt eating patterns to training demands with respect to amount, quality, and timing of food intake. He learns to fuel during exercise using sweat rate calculations to replace fluids, electrolytes, and carbohydrates. To achieve a higher carbohydrate intake during exercise, he trains his GI tract to absorb more carbohydrates. Furthermore, he learns how to recover properly to restore muscle glycogen, replace lost fluids and electrolytes, and repair muscle tissue challenged by interval training or long runs. Finally, he conquers the soda challenge, switching to water and using urine color as a guide to maintain hydration status, thereby supporting his physiological needs to maintain thermoregulation during exercise.

A recipe for success? Yes for sure!



SIDEBAR

Nutrition Assessment for a Neo-Runner

Any clinical work with a client or patient requires a thorough assessment. The nutritional assessment includes A, B, C, D, and E steps along the Nutrition Care Process (NCP) by the Academy of Nutrition and Dietetics (<http://www.eatright.org/HealthProfessionals/content.aspx?id=7077>), and these should be performed by a Certified Specialist in Sports Dietetics (CSSD). For the purpose of this case study, we will hypothetically assume the following data as per assessment through a CSSD.

Anthropometrics/Body Composition

A DXA body composition test is scheduled and shows a body composition of 33% with a body mass of 70 kg and a BMI of 27 kg/m². A decrease of approximately 5 kg in body mass (ideally) from fat mass will predict a decrease in percent body fat to 27%. To prevent muscle loss, dietary adjustments are necessary.

Baseline weight (kg): 70

Height (m): 1.61

Baseline % body fat: 33%

Baseline fat (kg): 23.1

Baseline fat-free mass (kg): 46.9

Baseline BMI (kg/m²): 27

Goal weight (kg): 65

Goal % body fat (%): 27.8

Goal fat (kg): 18.1

Goal fat-free mass (kg): ~46.9

BMI (kg/m²): 25

Increasing the runner's protein intake will help with maintenance of muscle tissue, satiety on a lower energy intake, and increased thermogenesis, all of which help with weight loss.

Biochemical

As part of the nutritional assessment, we also are concerned about this neo-runner's nutritional status and perform the biochemical assessment that stands for "B" as part of the NCP. In collaboration with the physician, the sport dietitian recommends a complete iron profile (because iron is really important for red blood cell mass based on endurance training). Furthermore, a complete blood count provides data on red and white blood cells and also is ordered. A metabolic panel provides data on electrolytes, serum levels of calcium, liver enzymes, and fasting glucose, to name a few. Because of his overweight status, a lipid panel is added to the assessment. Finally, vitamin D status is part of this routine laboratory profile.

Clinical

The clinical assessment of our subject has already been performed with the medical doctor. The sport dietitian checks

areas such as dietary supplement and use of prescription medications to rule out nutrient-drug-supplement interaction and ensures safe effective supplementation if warranted. Other medical history included in the clinical assessment specifically pertaining to sport participation also highlights nutritional issues such as relative energy deficiency and associated endocrine, cardiovascular, and musculoskeletal complications.

Dietary

The dietary assessment requires a thorough clinical interview that pertains to the runner's diet history and usual dietary intake. Various apps help with client assessment that make it more fun and provide more tracking opportunities between the sport dietitian and the runner. Some of these apps have been summarized recently by Professionals in Nutrition for Exercise and Sport (PINES) and are available from www.pinesnutrition.org. My Fitness Pal probably is the most commonly used app to help with tracking, after the initial assessment, which includes interviewing the client for typical meals, meal times, snacking, late-night eating, and access to healthy food in grocery stores and farmer's markets or other community-based good food venues. Budget and time availability also are critical, along with the assessment of general nutrition knowledge and skill in the kitchen.

Environmental

Finally, to complete the nutritional assessment, we also need to understand his training plan and try to estimate his energy requirement (EER). One of the quickest ways to do that is to use the formula by the Dietary Reference Intakes with a physical activity coefficient of 1.11 to 1.25 and 1.12 to 1.27 to account for activity level on resting days and running days, for males and females, respectively:

EER males = $(662 - 9.53 \times \text{age (45 years)}) + \text{PA} \times (15.91 \times \text{wt (kg)} + 539.6 \times \text{ht (m)})$

EER females = $(354 - 6.91 \times \text{age (45 years)}) + \text{PA} \times (9.36 \times \text{wt (kg)} + 726 \times \text{ht (m)})$

Calculations must be adjusted as the client goes through the recommended weight loss to account for changes in body mass.

More detailed assessment of daily energy expended in exercise also can be useful, but for the purpose of a case study, categorizing training days along the spectrum of easy/off, moderate, and hard probably is the most practical when making recommendations for adjusting energy (caloric) intake.

Other areas of inquiry under "E" or environmental assessment include questions pertaining to his home and work environment and geographical/climatic factors such as cold, altitude, or heat/humidity.

Once the nutritional assessment has been completed, a nutrition diagnosis is developed that guides the nutrition intervention and how the client's dietary changes are monitored. These all complete the NCP.

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efficacy of sport nutrition services for athletes. Dr. Meyer is a working group member of the International Olympic Committee Medical Commission related to nutrition and sport. Finally, she also promotes food literacy using creative educational approaches, which her graduate students deliver to the local community.

CONDENSED VERSION & BOTTOM LINE

A novice runner is led through the process of nutrition assessment and the development of strategies to improve current dietary trends, food awareness, and knowledge and skill in the kitchen. Sport nutrition approaches focus on periodized eating and fueling, focusing on adjusting food intake to exercise demands and trialing a variety of fueling approaches. Finally, the nutritional support emphasizes race preparation, including carbohydrate loading and eating/fueling on race day.