Carbohydrate and Fluid Requirements for Endurance Runners

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Introduction

As for any athletic event, proper training for endurance running is imperative for achieving optimal success. Training for most endurance running events includes periods of moderate-high intensity runs lasting between 50-90% of the ultimate race distance. Included in that criteria, as will be the focus of this chapter, is training for half and full marathons. For the purposes of this chapter, endurance running can be defined as continuous running over a distance of at least 10 kilometers, but not exceeding 50 kilometers. In addition to quality training sessions, another crucial factor for optimal endurance running performance is fuel type and intake both during training, and pre and post-race. Two main objectives will be outlined to determine optimal nutritional choices for endurance runners:

1. Carbohydrate requirements

- Pre-competition
- During competition
- Post competition
- Carbohydrate Loading
- Training Day Nutrition

2. Fluid requirements

- Water intake
- Electrolytes in Fluid
- Determining Hydration Status

http://www.athletico.com/2012/04/04/hip-flexor-tightness-in-distance-runners/

Carbohydrates

There is much debate regarding the increase in the amounts of nutrients needed for endurance runners, particularly macronutrients. In order to analyze this debate, we will begin by exploring the suggested amounts of carbohydrate to help these athletes with adequate nutrition and improvement of performance. A carbohydrate is defined as an organic compound containing hydrogen and oxygen, and typically broken down to release energy in the body. Carbohydrates supply muscles with fuel (Burke et al. 2004), and the availability of carbohydrates in the body has the ability to alter performance, particularly during runs lasting longer than 90 minutes (Burke et al. 2004). The ingestion of carbohydrates should be a practice integrated into an endurance runner's every day diet, but particularly during training seasons. The importance of increased carbohydrate intake is less vital in short high-intensity workouts, such as interval runs, yet still plays a roll in the overall diet of an endurance athlete (Burke, et al. 2004).

Pre-competition

Prior to any endurance event, a runner must be aware of energy needs and timing of carbohydrate ingestion. In general, pre-competition guidelines for carbohydrates are as follows:

- 4 hours prior to competition: 4-5 g/kg body weight
- 1 hour prior to competition: 1 g/kg body weight

For example, a 135 lb female is about to participate in a full marathon (26.2 miles). If the marathon begins in the morning, the most reasonable approach to carbohydrate consumption would be following guidelines for 1-2 hours prior to competition. There is no need for her to wake up at 5 am simply to ingest carbohydrates, as her mental energy stores will be submitted to an early rise. If she plans to eat a meal about 2 hours prior to competition, she would require about 2 g/kg body weight, therefore requiring about 122 grams of carbohydrate. By ingesting a double bowl of oatmeal, 3 pieces of dried fruit, and one piece of whole-wheat toast, her carbohydrate needs would be met.

During competition

Ingesting carbohydrates during competition can be highly individualized based on race distance and runner preference. Research recommends that during an endurance event, some level of CHO be ingested to ensure body processes and reactions remain stable, as well as maintenance of mental acuity.

Despite these recommendations, the ingestion of CHO may be more difficult for endurance runners than other athletes because of the "joggling" movement produced during a steady run (Burke, et al. 2005). Luckily, concentrated carbohydrate solutions, or "sport gels" are a less fluid alternative that makes ingesting large amounts of CHO possible (Burke, et al. 2005). Unlike other athletic events, long distance running does not have "breaks" or "matches", therefore the timing of CHO ingestion during competition is crucial. Once an endurance runner begins to feel fatigued, their body has already lost a significant amount of muscle glycogen. Because adequate muscle glycogen levels are extremely hard to maintain after falling too low, Research recommends that CHO ingestion during an endurance run occurs before the athlete feels muscle fatigue. Keeping high levels of carbohydrate in the body system spares precious muscle glycogen needed to complete any event.

Post-competition

Following exercise, especially exhaustive runs, carbohydrates should be ingested within the 2 hour window immediately post-competition. The ingestion rate is slightly increased during this time, which results in increased glycogen synthesis (Burke et al. 2004). The post-competition carbohydrate intake should reach about 600 g within 24 hours, and can be divided into approximately 50 g/2 hours following the competition. (Burke et al. 2004). For the competitive endurance athlete, accumulating sources of carbohydrates is rarely an issue, as many marathon and half marathon events supply runners with adequate carbohydrate-rich sources post-run. These sources may include bagels, various fruits, yogurts, chocolate milk, and even alcoholic beverages.

Although not all sources must be consumed to recover, they do become available so the body does not reach a low point of muscle glycogen. If muscle glycogen storage drops to an unsafe level, there is risk for brain glycogen to deplete, rendering a runner incapable of full brain function. In this situation, carbohydrate ingestion is necessary and must occur immediately.

Carbohydrate-loading

The concept of carbohydrate loading has been introduced to endurance runners as a way of increasing muscle glycogen stores hours or days before an event. The use of carbohydrate loading is fairly popular in organized endurance events, such as marathons that host "all-you-can-eat" spaghetti feeds the night prior to the race. Although the concept has a sound background, there is little evidence to prove that carbo-loading is truly effective at increasing performance over a one-day endurance event (Hawley, et al. 1997). In most media, carbohydrate loading is praised as a "quick fix" to ensure muscle glycogen stores will be adequate during an event.

Although carbohydrate loading the night before an event has not proved to deliver physiological improvements (Hawley, et al. 1997) there is a "runner mentality" that carbohydrate loading the night before an event can do nothing but help. Although the science does not prove physiological changes, the mind of a runner can be put at ease through carbohydrate-rich dinners, such as spaghetti feeds run by the community. In practice, carbohydrate loading can only render benefits to a runner's muscle glycogen stores if practiced over the 3-5 days prior to the event (Hawley, et al. 1997).

Training Day Nutrition

As with many endurance athletes, endurance runners who compete throughout the year require an altered diet from a normal individual. This diet must include a focus on adaptation of carbohydrate intake to ensure good performance and adequate recovery (Burke, et al. 2005). This being said, every athlete is unique in their goals, training volume, and training intensity, and CHO ingestion should be individualized based on their body's caloric needs. A runner who is participating in a moderate duration or low-intensity training regime should ingest 5-7 g/kg body weight each day. One time this diet may be appropriate would be in the beginning stages of marathon or half marathon training. As the athlete's body is returning to an active and competitive state, the consistency of the body's muscle glycogen storage becomes more important, thus the increase in daily caloric intake.

A runner who is participating in training that is more vigorous or closer to competition should receive between 7-12 g/kg body weight throughout a day, while an endurance runner participating in an immediate event should consider increasing average calories to 10-12 g/kg body weight (Burke et al. 2004). This diet should not be maintained as activity level goes down, as this could be defined as a carbohydrate "loading" stage. With a decrease in exercise intensity and duration, carbohydrate loading becomes unnecessary, and in fact should not continue for the health of the athlete (Burke et al. 2004).

The source of carbohydrates throughout a training program can be either solid or liquid, as glycogen synthesis does not change depending on consistency of source (Burke et al 2004). Just as type of carbohydrate has little effect on glycogen synthesis, the spacing of meals throughout the day does not change the synthesis rates. Many endurance athletes find that ingesting different sources of carbohydrates allows their bodies to maintain adequate glycogen stores throughout training.

Between muscle glycogen storage and brain glucose, the body's constant need for carbohydrate sugars only increases as the body undergoes physical stress during high-duration events. Overall, the importance of carbohydrates within an endurance runner's diet cannot be denied.

http://idealbite.com/is-carbohydrate-loading-essential-for-optimal-endurance/

Fluid Requirements

One of the most important factors for maintaining proper physiological function during long-distance running is a person's hydration level. Hydration is accomplished through adequate water intake before, during, and after competition. Water is crucial for maintaining both core body temperature and optimal electrolyte concentrations. The amount of water needed depends on a variety of factors: intensity and duration of the exercise bout, environmental conditions (including temperature), and the body structure and state of hydration of the particular individual. This section will discuss the needs of water, electrolytes, and also some efficient ways to determine hydration status for long distance runs.

Water Intake

Maintaining proper hydration levels during long distance running events is imperative for both the safety and performance of the runner. About seventy percent of the runners competing in the 2010 Little Rock Marathon reported to having experienced 1 or more instances where dehydration hindered their performance, and over forty-five percent claimed that dehydration led to negative health effects (O'Neal, 2011). One of the biggest questions then, is how much water is necessary to meet most runners' needs. According to the current American College of Sports Medicine recommendations, a marathon runner should consume approximately 0.4-0.8 liters of water per hour throughout the competition (Beis, 2012). This estimated amount is to ensure the runner loses no more than 2-3% of their total body mass.

Other research, however, suggests that dehydration may not be a decrement to performance. In one particular study, Beis, Wright, and colleagues took a look at the drinking behaviors of elite male runners during marathon competitions. The study consisted of 10 male participants, (9 winners and 1 second place finisher) of 13 major city marathons (Beis, 2012). The average water intake for the runners was 0.55 liters/hour (within the recommended range). Research within this study does prove runners lost on average about 8.8% of their body mass throughout the competitions (about 4 times the recommended amount). Therefore, the results revealed no significant correlations between water intake rates and drinking duration on marathon performances. Further research is required to determine the effects of dehydration on optimal long distance running results.

Another major concern regarding water intake during long distance running events is deciding how much consumption is too much. When water intake rates exceed sweating rates, the electrolyte balance can be disrupted, resulting in a condition known as hyponatraemia (Montain, 2006). A lot of research suggests that severe or prolonged hyponatraemia can cause potential harm to a runner. However, in one study by Montain, Cheuvront, and Sawka, research was found that runners during a 42 km run who secreted more salty sweat (electrolytes) were able to finish the race with no apparent negative side effects. Therefore, whether or not excessive water intake negatively effects long distance running performance or health demands further investigation.

http://gamerfitnation.com/2012/10/hydrating-tips-for-running/

Electrolytes in Fluid

One of the more popular topics in long distance running as well as in other sports is the effect of electrolyte-containing fluids on hydration and performance. As discussed briefly in the previous section, there is a need for further research on hyponatraemia's effects on performance. However, one particular study examined the effects of electrolyte-containing fluids on the timing of the onset of hyponatraemia (Montain, 2006). Research found that runners who competed in 42 km races experienced a delay in the development of hyponatraemia when having consumed an electrolyte-containing beverage as opposed to just water. Furthermore, another study examined the direct effects of hydration status on 146 men and 130 women competing in the Little Rock Half or Full-Marathon. Each runner was divided into either a Low, Moderate, or High group based on training volume, expected performance, and running experience (O'Neal, 2011). The study found that runners in the High group (those with more running experience and ability) consumed a greater amount of sport (electrolyte-containing) beverages throughout the race as compared to those in the middle and low groups. Additionally, those in the High group claimed that sport beverages were more beneficial for hydration and performance than just plain water for running events lasting more than 1 hour (O'Neal, 2011). Based on the above research, a conclusion can be made that consuming electrolyte-containing beverages as opposed to plain water may be beneficial to the performance and health of the runner.

Determining Hydration Status

On a fairly warm fall afternoon in Shell Lake, Wisconsin, young varsity cross-country runner Bailey was excited to begin her third race of her senior year. Before the race started she noticed that her mouth was a little dry. Thinking that it was just basic pre-race nerves, she decided to give the race her best shot. About two-thirds into the race, one of the spectators rushed over to the side of the trail where Bailey was found lying unconscious on the ground. Fortunately, after receiving medical treatment she ended up being just fine. The day after the race, Bailey reported that she knew she was a little thirsty, but had no idea that she was at such a dangerous level of dehydration. She really wished she had known an efficient way to check her hydration level prior to the race.

The previous sections discussed the effects of fluid intake and hydration on long distance running. However, how can one tell if they are sufficiently hydrated before, during or after a race? The first thing to always analyze is one's perceived level of thirst. Dry mouth, light-headedness, or even fatigue are some of the obvious signs of thirst and dehydration. Next, a way to determine hydration status after a race is completed is to measure one's body mass and compare it to the body mass before the race. As noted in a previous section, dehydration is generally defined as a 2-3% loss in body mass (Beis, 2012). Finally, one of the easiest and most efficient ways to determine hydration status is to examine urine color. In fact, some research suggests that urine color is as good of an indicator of hydration status as plasma or urine osmolality or urine specific gravity (Kavouras, 2002). When analyzing urine, a more yellowish and odorous color is generally a strong indicator of dehydration. Conversely, clear and odorless urine indicates proper hydration. In conclusion, runners can use a few simple methods to determine their hydration status before, during and after competition in order to prevent harm and help with performance.

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