



www.NutritionDimension.com  
 400 W. Hersey St. #2, Ashland, OR 97520  
 1-888-781-5388

# Liquid Nutrition for Athletes

By Marie Dunford, PhD, RD

*Revised December 2008*

*Download before December 31, 2009*

*Complete exam for credit before December 31, 2010*

*Course ID code: LIQ09*

*See Continuing Education credit information on page 12*

**W**ould anyone have guessed that Ensure<sup>®</sup> and similar meal replacement products designed primarily for elderly and seriously ill people would find a new market — young athletes? It's part of a trend to use liquid nutrition products of all kinds to supplement or replace solid food and plain water, and to maximize nutrient intake for training and performance.

For fitness professionals, the use of these products provides opportunities to help competing and recreational athletes in training achieve proper nutrition in a pleasant, easy-to-use form. These beverages come in a variety of formulations and target one or more pre-, during or post-exercise goals. Before leaping in, let's learn as much as we can about them.

Liquid nutrition products are popular with today's athletes for a variety of reasons. These include the need for high carbohydrate and fluid intake to support physiologically rigorous training and competition, the ease with which liquids can be consumed during exercise, the convenience (especially when traveling), the ability to replace solid food with liquids of equal nutritional value and the ability to precisely calculate and track the types and amounts of nutrients consumed. Research has shown the benefits of well-formulated sports beverages on performance and savvy advertisers have made athletes aware of such benefits.

Fifty years ago, water was the only fluid-replacement beverage available for athletes. Although athletes were often prohibited from drinking water during exercise or training (prohibiting water is never recommended now), they were encouraged to do so after practice and as a normal part of their diet. It should also be noted that while sports beverages enjoy great popularity, water is still an appropriate beverage in many circumstances. For example, most athletes who engage in exercise of less than 45 minutes do not require carbohydrate-containing beverages during exercise.

During the 1960s the first and most successful “sports beverage” was developed. It was intended to provide energy and replace nutrients lost in sweat; it contained glucose, water, sodium, chloride and potassium. Gatorade® was developed at the University of Florida (whose team name is “the Gators”) and pioneered the idea of providing nutrients that athletes need in a liquid form. For many years “Gatorade” and “sports beverage” were synonymous, but gradually new products have emerged, until today there are many “sports beverages” on the market. The basic idea remains the same, however: maintaining proper hydration, providing carbohydrate fuel and quickly replenishing regulatory micronutrients allows prolonged or sustained performance and delayed fatigue.

Also, the development of liquid meal replacement formulas for elderly and critically ill medical patients allows athletes to ingest known amounts of macronutrients — protein, carbohydrate and fat — on a systematic basis. For an athlete trying to regulate weight, such products can be convenient and healthful.

Fluid and electrolyte balance, and carbohydrate intake timing and amount, have been studied extensively and are now better understood by sports medicine consultants to the food and beverage producers. Hence, product formulations have changed and the number and variety of sports beverages available has substantially increased (1,2,3,4,5). “Sports beverages” contain such varying amounts of water, carbohydrates and electrolytes that the term has little meaning, however, the appropriate formulation can be tremendously beneficial for an athlete. Hydration and nutrition guidelines must be individualized and take into account differences in body size, sweat rates, and sodium loss. Two athletes on the same team may need vastly different amounts and types of sports beverages.

The composition of a “sports beverage,” not its advertised benefits, determines if it is an appropriate choice before, during and after exercise. “Energy drinks” are also highly advertised, but their high carbohydrate and caffeine contents make them much different.

## Sports beverages

- **Sports beverages consumed before and during exercise.** This type of sports beverage targets athletes who benefit from carbohydrates and fluid before exercise. The percentage of carbohydrate is 4 to 8 percent, with most of the beverages having 6 percent carbohydrate. Six percent carbohydrate is typically well tolerated by most athletes. Formulations greater than 8 percent are emptied from the stomach more slowly and could cause gastrointestinal upset. If the concentration proves to be too great, athletes may dilute the beverage with water or choose a 4 percent carbohydrate beverage (*e.g.*, Hydrade®, Gatorade G2®).

Carbohydrates are in the form of glucose, glucose polymers (chains of glucose), sucrose, fructose, maltodextrin and/or high-fructose corn syrup because a mixture of carbohydrates results in greater absorption and oxidation than a single carbohydrate source (6).

Pre-exercise beverages contain approximately 10 to 19 gm of carbohydrate per 8 oz serving. Beverages that are 6 percent carbohydrate provide 14 to 15 gm of carbohydrate per 8 oz. Pre-exercise beverages also contain small amounts of electrolytes, often 50 to 150 mg of sodium and 30 to 50 mg of potassium. A few beverages have larger amounts for those athletes who lose large quantities of sodium and potassium when sweating (*e.g.* Gatorade Endurance Formula®).

Examples of several beverages are shown in the chart on the following page. Nutrition information was obtained from the product website, and is based on an 8 oz serving, although 8 oz containers, while still available, are now less common than 16, 24 and 32 oz containers.

| Pre-exercise Sports Beverages |              |               |          |             |             |                |
|-------------------------------|--------------|---------------|----------|-------------|-------------|----------------|
| Product name                  | Serving size | Energy (kcal) | CHO (gm) | Percent CHO | Sodium (mg) | Potassium (mg) |
| Accelerade*                   | 8 oz         | 80            | 15       | 6           | 120         | 15             |
| AllSport Body Quencher        | 8 oz         | 70            | 20       | 8           | 55          | 50             |
| Gatorade Endurance Formula    | 8 oz         | 50            | 14       | 6           | 200         | 90             |
| Gatorade G2                   | 8 oz         | 25            | 7        | 3           | 110         | 30             |
| Gatorade Thirst Quencher      | 8 oz         | 50            | 14       | 6           | 110         | 30             |
| Gatorade Tiger                | 8 oz         | 50            | 14       | 6           | 135         | 40             |
| Hydrade**                     | 8 oz         | 55            | 10       | 4           | 91          | 77             |
| POWERade                      | 8 oz         | 78            | 19       | 8           | 54          | 30             |

\*Also contains 4 gm protein  
 \*\* Also contains 5.1% glycerol which binds water

• **High carbohydrate sports beverages.** High carbohydrate sports beverages are useful whenever athletes need a substantial carbohydrate source: several hours before exercise, immediately after exercise, and when carbohydrate loading. These products are inappropriate as a carbohydrate source during exercise because the concentration is too great and would cause gastrointestinal distress.

The carbohydrate content ranges from approximately 25 to 45 gm. They also contain greater than 8 gm of protein. Scientific studies have confirmed that both carbohydrate and protein immediate after exercise aids in recovery by providing the nutrients the body needs to resynthesize muscle glycogen and to repair and build muscle tissue. There is also some sodium and potassium in these drinks, which are often advertised as “recovery” beverages. Some of these beverages can also be used as a meal replacement because they contain sufficient amounts of calories, carbohydrate, protein and fat.

Various types of athletes find meal replacement beverages useful. In the case of a high school gymnast, an 8 oz meal replacement beverage could provide the calories and nutrients she would normally obtain by eating breakfast — which she often skips as she rushes from early morning practice to class. A young professional tennis player might keep such a beverage in his carry-on luggage to consume at the airport after his last match. Exhausted athletes would rather sleep than eat, and a meal replacement beverage may provide needed calories with little effort. The chart on the following page illustrates the nutrient content of some recovery and meal replacement beverages. And, as noted, weight control is often easier if a food is pre-portioned and the athlete knows how many calories and nutrients are contained in each portion.

Sports beverage manufacturers keep a careful watch on the scientific publications related to fluid, carbohydrate, and electrolyte intake and improved performance. They have successfully developed drinks that help athletes meet the demands of their training. There are significant differences between beverages that can be used prior to, during, and after exercise, although there appears to be few differences among the drinks within a category (7).

New beverages are always coming on to the market. Some are simply lightly sweetened water with vitamins added; others contain protein, which is needed during recovery and may be beneficial during prolonged exercise as well. Beverages are also constantly being reformulated, so it is a good idea to check the website of the beverage periodically to see if the formulation has changed.

| <b>Recovery &amp; Meal Replacement Beverages</b> |                     |                      |                 |                     |                 |                    |                       |
|--|---------------------|----------------------|-----------------|---------------------|-----------------|--------------------|-----------------------|
| <b>Product name</b>                              | <b>Serving size</b> | <b>Energy (kcal)</b> | <b>CHO (gm)</b> | <b>Protein (gm)</b> | <b>Fat (gm)</b> | <b>Sodium (mg)</b> | <b>Potassium (mg)</b> |
| Boost  | 8 oz                | 240                  | 41              | 10                  | 4               | 130                | 400                   |
| Boost High Protein                               | 8 oz                | 240                  | 33              | 15                  | 6               | 170                | 380                   |
| Boost Plus*                                      | 8 oz                | 360                  | 45              | 14                  | 14              | 170                | 380                   |
| Ensure   | 8 oz                | 250                  | 40              | 9                   | 1               | 190                | 390                   |
| Ensure High Protein                              | 8 oz                | 230                  | 31              | 12                  | 1               | 290                | 500                   |
| Ensure Plus*                                     | 8 oz                | 350                  | 50              | 13                  | 11              | 220                | 500                   |
| Gatorade Protein Recovery Shake                  | 1 can<br>11 oz      | 270                  | 45              | 20                  | 1.5             | 260                | 480                   |
| Low-fat chocolate milk                           | 8 oz                | 170                  | 26              | 8                   | 3               | 153                | 425                   |

\*Can be used as a meal replacement beverage

## Criteria for Consuming Sports Beverages

Athletes often ask if they should consume water or a sports beverage — of course, manufacturers promoting their products have one answer, but in some cases water is still the most appropriate beverage. Many factors must be considered; a primary factor is the need for carbohydrate replenishment during exercise.

Athletes who train or perform continuously for more than one hour should generally consume 2-3 cups of a 6-to-8 percent carbohydrate beverage two to three hours before exercise. A rule of thumb for fluid intake is about 5 to 7 ml/kg body weight (or about 1 oz/10 lb body weight) at least four hours prior to exercise, but the exact amount is determined by current state of hydration, body size, sweat rate, and individual tolerances (8).

A carbohydrate beverage conveniently provides the athlete with carbohydrates and water, both of which help to delay the onset of fatigue. A more concentrated carbohydrate beverage (*i.e.*, greater than 8 percent) would likely exceed the rate of gastrointestinal glucose absorption and likely result in gastrointestinal distress unless the gut is well trained to tolerate higher concentrations. Athletes who perform for only a short period of time (*e.g.* 100 meter runner), will not fatigue due to lack of carbohydrates — therefore only water prior to performance is appropriate (7, 8).

Athletes who perform continuous exercise for more than one hour (*e.g.* marathon runners), or high-intensity intermittent exercise for one to four hours (*e.g.* soccer players), are at risk for hypoglycemia, dehydration and fatigue. Both carbohydrates and fluids are needed during exercise and, as a practical matter, a carbohydrate-containing beverage “kills two birds with one stone.” Most athletes drink every 10 to 20 minutes during exercise and the amount of carbohydrate that is associated with improved performance varies depending on the duration of the exercise. For example, exercise lasting just one hour requires less than 30 gm of carbohydrate.

As the duration of the exercise increases, the need for carbohydrate intake during exercise increases from up to 50 gm/hr for 1.5 hours of exercise to up to 70 gm/hr for marathoners. Athletes in exceptionally demanding events, such as cyclists in the Tour de France, appear to benefit from a carbohydrate intake of 60 to 90 gm/hr (6). These prolonged and demanding sports deplete liver and muscle glycogen so the carbohydrates in the sports beverage provide a much-needed source of energy. Near the end of a very demanding sport, such as running a marathon, blood glucose is an important fuel source. It is no surprise that carbohydrate-containing beverages are available to athletes during continuous exercise. A beverage with a carbohydrate concentration greater than 8 percent is more likely to delay gastric emptying, which would likely cause gastrointestinal distress, but also provides a larger amount of carbohydrate. Athletes use trial and error to determine just how much carbohydrate they can tolerate. Water would provide fluid but no carbohydrate (8, 9).

High carbohydrate beverages with some protein are often consumed immediately after exercise and during the next several hours of the recovery period. Carbohydrates, water and electrolytes lost during exercise must be replenished and muscle tissue repaired. Recovery time is limited for most competing athletes because they train or compete nearly every day. One of the most important factors in re-synthesizing glycogen is carbohydrate consumption immediately after exercise. The presence of some protein helps to stimulate muscle protein synthesis. A popular post-exercise beverage is chocolate milk.

Sodium after exercise is beneficial because it helps the body retain water and helps maintain the body’s drive to drink. High carbohydrate recovery beverages contain all the nutrients known to be important for replenishment in the minutes and hours after exercise. A 6 to 8 percent carbohydrate beverage would not provide enough carbohydrates; water would only replenish the fluid lost (8,9).

Knowing the demands for fluid, energy and electrolytes before, during and after training will determine which beverages will be beneficial or detrimental. In addition, the individual’s sweat rate and the loss of sodium during exercise (“salty sweaters”) should be carefully considered. The chart on the following page contains a summary.

| <b>Carbohydrate, Fluid and Electrolyte Guidelines</b> |   |
|---|---|
| <b>Up to 4 hours before exercise</b>                  | Fluid consumption should be ~5-7 ml/kg of body wt (~1 oz/10 lb of body wt) at least 4 hr prior to exercise if adequately hydrated. An additional ~3-5 ml/kg should be consumed 2 hr prior if athlete is dehydrated. Athletes performing more than 1 hr of exercise usually chose a 6-8% carbohydrate beverage as part of their fluid intake. In the 2 hrs prior to exercise, amount of carbohydrate and fluid is based on amount of time remaining before exercise begins and the gastrointestinal tolerance of athlete.  |
| <b>During exercise</b>                                | Each athlete should have a customized plan to prevent excessive loss of fluid or sodium that has been developed by trial and error during training. During exercise lasting more than 1 hr, most athletes consume a 6-8 percent carbohydrate beverage in small quantities (~4-12 oz) at 15-20 min intervals. Including sodium maintains the drive to drink and may help to prevent hyponatremia (low blood sodium) in ultraendurance athletes. Endurance and ultraendurance athletes should match their fluid intake to their fluid losses. Excess fluid consumption should be avoided. |
| <b>After exercise (recovery)</b>                      | Ingestion of carbohydrate should begin immediately. The recommended level is 1.5 gm of carbohydrate per kg of body weight within 1 hr followed by an additional 0.75-1.5 gm/kg within the next 3 hr. At least 8 gm of high quality protein should be consumed. Sodium and other electrolytes should be included. Either high carbohydrate/protein/electrolyte beverages or high carbohydrate/moderate protein foods, lightly salted, and water is recommended during recovery.  |

Athletes will undoubtedly ask which sports beverage is “best.” There is no single correct answer as the demands of training and performance must be considered for each sport. A sprinter may choose water before a race but a distance runner would benefit from a pre-race 6 to 8 percent carbohydrate beverage. There will be differences among teammates performing the same exercise. One athlete may prefer a high carbohydrate beverage after exercise while another may prefer high carbohydrate foods and water. As is always the case in sports nutrition, the guidelines offer a good framework but the individual’s needs and preferences must be considered before a decision is made.

Athletes who need more than 5000 kcal daily (*e.g.* male cross country skiers, body builders, ultraendurance athletes, professional football players) may find that meal replacement beverages are a good supplement to their food intake. Those with exceptionally high calorie demands (the  $\geq 8000$  kcal needed by male cyclists who race in the grueling Tour de France, for example) would be hard-pressed to meet their calorie needs with food alone. They often supplement their food intake with meal replacement beverages that provide a concentrated source of calories and nutrients. In fact, Tour de France riders begin liquid nutrition replenishment as soon as the day’s racing is over.

## ‘Energy’ drinks

Some of the most highly advertised drinks are the so-called “energy” drinks (10,11) marketed to competing and recreational athletes, as well as to people with demanding work schedules. Advertising for these drinks tends to focus on an individual’s lack of energy or fatigue. Manufacturers have targeted much of their advertising to young adults.

Fatigue in athletes can be a result of insufficient calories, insufficient carbohydrates, dehydration, iron-deficiency anemia, lack of sleep, overtraining, increased body temperature and/or changes in cellular acid-base balance, to name a few (11). Determining the source(s) of an athlete’s fatigue is the key to reversing and/or possibly delaying the onset of fatigue in the future. However, to athletes struggling with fatigue, it is very tempting to buy a drink that simply promises more energy.

Let’s take a closer look at the composition of these “energy” drinks.

| Energy Drinks        |                 |               |          |   |
|----------------------|-----------------|---------------|----------|---|
| Product name         | Serving size    | Energy (kcal) | CHO (gm) | Caffeine (mg)                                     |
| Red Bull             | 250 ml (8.3 oz) | 110           | 28       | 80 (also available as sugar free. No kcal or CHO) |
| SoBe Adrenaline Rush | 246 ml (8.3 ml) | 140           | 37       | 86 (combination caffeine and guarana)             |
| AMP Energy Drink     | 248 ml (8.4 oz) | 110           | 29       | 71 mg (combination caffeine and guarana)          |
| Rock Star Energy     | 240 ml (8 oz)   | 140           | 31       | 80 mg (combination caffeine and guarana)          |
| Venom Energy Drink   | 250 ml (8.3 oz) | 130           | 29       | 100 mg (combination mate and guarana)             |

Most energy drinks have about 30 to 35 gm of carbohydrate in an 8 oz serving (the usual serving size — although some 16 oz energy beverages are on the market). Nearly all contain caffeine, some from herbal sources such as guarana, kola nuts or maté. The amount of caffeine is not required to be stated on the label, but energy drinks frequently contain 75 to 80 mg. However, many companies are manufacturing variations of their original products and these newer products may contain more.

Although the drinks contain about 30 to 35 gm of carbohydrate, the addition of caffeine makes energy drinks a poor choice for some athletes. Caffeine is a central nervous system stimulant. For those who are caffeine-naïve (never or rare users) or caffeine-sensitive, a large dose of caffeine can cause a jittery, nervous response. They feel “stimulated” rather than “energized,” which may be detrimental to their performance, training session or ability to sleep. A useful comparison is to an 8 oz caffeinated soft drink, which contains 26 gm of carbohydrate and approximately 20 to 30 mg of caffeine. An energy drink may contain too much caffeine and result in nervousness, light-headedness and nausea. Athletes can establish their tolerance through trial and error.

Caffeine may enhance the performance of well-trained endurance athletes. It appears that the effective dose is 5 to 6 mg of caffeine/kg of body weight at least one hour prior to endurance exercise. Although the exact mechanisms are not known, caffeine most likely improves performance because of central nervous system stimulation that alters perception of fatigue. Athletes should be aware that caffeine may be a controlled substance under their athletic organizations' doping guidelines but most athletes will not exceed the doping threshold because such levels would produce side effects, such as rapid heartbeat and the jitters, that would negatively impact performance (11).

Liquid nutrition can be an important part of many athletes' diets. Carbohydrate and fluid intake before and during training and competition can enhance performance for many athletes. Carbohydrate, protein, and fluid intake after exercise is beneficial for athletes and sports beverages provide a convenient way to obtain these nutrients. For athletes with high calorie and carbohydrate needs, sports beverages are a useful dietary supplement.

Although sports drinks are advertised to *all* athletes — from highly trained Olympians to recreational athletes — many casual exercisers do not need the additional carbohydrate and calories that these drinks provide. These drinks may be contributing to weight gain. Additionally, carbohydrate provided by whole foods, such as fruits, vegetables, whole grains and beans, results in an increase in fiber, vitamin and mineral intakes. Substituting carbohydrate drinks for nutrient dense carbohydrate foods will impact daily nutrient intake.

Most energy drinks are highly caffeinated and should be consumed with caution, although caffeine consumption within the recommended guidelines may enhance the performance of endurance trained athletes. However excessive caffeine intake could negatively affect the athlete's performance and in rare cases result in disqualification.

With so many sports and energy beverages on the market, the athlete must choose wisely to obtain the nutrients needed in the proper concentrations. Sports beverages should be considered in the context of the overall diet. Those who work with athletes must be knowledgeable about the nutrient content of these beverages and seek out information about new beverages as they come onto the market. Information regarding the nutrient content of most sports beverages is easily obtained via the company's website. Considering the individual's circumstances, a product like Ensure™ may be useful for highly-trained athletes as well as for elderly patients.

## References

1. Latzka WA and Montain SJ. Water and electrolyte requirements for exercise. *Clinics in Sports Medicine* 1999; 513-524.
2. Nueffer PD, *et al.* Improvements in exercise performance: effects of carbohydrate feedings and diet. *J Appl Physiology* 1987; 62:983-988.
3. Schabert EJ, *et al.* The effect of a preexercise meal on time to fatigue during prolonged cycling exercise. *Medicine and Science in Sports and Exercise*. 1999; 31:464-71.
4. Sherman WM, *et al.* Effects of four hour pre-exercise carbohydrate feedings on cycling performance. *Med Sci Sports Exerc* 1989; 21:598-604.
5. Ivy JL. Glycogen resynthesis after exercise: effect of carbohydrate intake. *Int J Sports Med*. 1998; 19 Suppl 2:S142-S145.
6. Jeukendrup A. Carbohydrate supplementation during exercise: Does it help? How much is too much? *Sports Science Exchange* 2007; 20(3). Accessible at [www.gssiweb.com](http://www.gssiweb.com)

7. Coombes JS and Hamilton KL. The effectiveness of commercially available sports drinks. *Sports Med* 2000; 29:181-209.
8. Sawka MN, *et al.* and the American College of Sports Medicine. Position stand on exercise and fluid replacement. *Med Sci Sports Exercise*, 2007; 39(2): 377-390.
9. Position of the American Dietetic Association, Dietitians of Canada, and the American College of Sports Medicine: Nutrition and athletic performance. *JAm Diet Assoc.* 2000; 100:1543-1556.
10. Dunford M. Sports beverages. *Today's Dietitian*, 2002; 4(10): 12-15.
11. Dunford M and Doyle JA. *Nutrition for Sport and Exercise* 2008; Thomson/Wadsworth, Belmont, CA.

## Examination (LIQ09)

1. In most circumstances, a sports beverage should contain approximately \_\_\_\_ percent carbohydrate if it is to be consumed by an athlete two to three hours prior to performance?
  - a. 2 to 3 percent
  - b. 4 to 5 percent
  - c. 6 to 8 percent
  - d. 8 to 10 percent
  - e. 10 to 15 percent
  
2. A client has just started training for a marathon. He understands the value of consuming a 6 to 8 percent carbohydrate beverage during his 1-1/2 hour training run, but wonders if he should take in a more concentrated carbohydrate beverage in order to consume more carbohydrates. What would you recommend?
  - a. A more concentrated beverage will provide more carbohydrate and is highly recommended.
  - b. A more concentrated beverage will provide more grams of carbohydrate but is recommended only during competition, not during training runs.
  - c. A more concentrated carbohydrate beverage is not recommended, but a carbohydrate/protein beverage is recommended during training runs.
  - d. A more concentrated carbohydrate beverage is not recommended because the amount of carbohydrates in the beverage would exceed the rate at which it could be absorbed, causing gastrointestinal distress.
  - e. Water only is the most appropriate beverage for long training runs as any carbohydrate can cause gastrointestinal upset.
  
3. Who would NOT likely benefit from a carbohydrate-containing beverage 30 minutes before performance?
  - a. 100 meter swimmer
  - b. Long distance swimmer
  - c. Tour de France rider
  - d. Professional soccer player
  - e. Ultra-endurance athlete

4. You are looking at the label of a sports beverage specifically formulated for consumption during the recovery period. In addition to carbohydrates and electrolytes it also contains protein. Why?
  - a. Protein ingested during the recovery period helps to reduce bloating.
  - b. Protein helps to stimulate muscle protein synthesis.
  - c. Protein helps the athlete maintain the drive to drink.
  - d. Protein is not thought to provide any specific benefit but is added because athletes always focus on protein as an ingredient.
  - e. Protein is added as binding agent that helps increase carbohydrate absorption.
  
5. One of your clients, a dedicated recreational athlete who exercises every day, is complaining about fatigue. She asks you what is causing her fatigue. How would you respond?
  - a. Too few calories, carbohydrates and dietary iron
  - b. Overtraining and dehydration
  - c. Lack of sleep
  - d. Increased body temperature and altered acid/base balance in cells due to exercise
  - e. All of the above could contribute to fatigue
  
6. The client mentioned in question #5 usually combats fatigue by drinking a caffeinated soft drink, a beverage she doesn't normally consume on a daily basis. However, a friend told her that an energy drink is a better way to combat fatigue. She is wondering how the two beverages compare. How would you respond?
  - a. Both have about the same amount of carbohydrate and caffeine.
  - b. The energy drink has more carbohydrate but about the same amount of caffeine.
  - c. The energy drink likely has substantially more caffeine than the soft drink.
  - d. The soft drink likely has substantially more caffeine than the energy drink.
  - e. The energy drink has more caffeine but doesn't contain carbohydrate.
  
7. Which type of athlete would most likely see performance benefits associated with caffeine ingestion?
  - a. Strength athletes, such as discus throwers
  - b. Recreational athlete, such as novice tennis players
  - c. Short duration competition athletes, such as sprint swimmers or sprint runners
  - d. Well-trained endurance athletes
  - e. None of the above
  
8. A local volunteer organization is putting on a benefit marathon and needs to know which 6 to 8 percent carbohydrate beverages would be appropriate. Which of the following would you recommend?
  - a. AllSport, Gatorade, Thirst Quencher, Accelerade or PowerAde.
  - b. Ensure, Gatorade G2 or Gatorade Tiger.
  - c. Gatorade Endurance Formula, Ensure Plus or Ensure High Protein.
  - d. AllSport, Red Bull or Ensure
  - e. None of the beverages listed above would be recommended.

9. When would a meal replacement beverage be an appropriate choice for a well-trained athlete?
- a. 30 minutes prior to performance
  - b. At 15 minute intervals during performance
  - c. At 20 minute intervals during performance
  - d. Between working out and class as a substitute for breakfast
  - e. A meal replacement beverage is not appropriate for a well-trained athlete. They need real food.
10. An athlete does not eat after long, hard practices and instead drinks only a 6 to 8 percent carbohydrate sports beverage. What advice would you give to this athlete?
- a. Continue to drink the 6 to 8 percent carbohydrate beverage, it provides all the nutrients that you need during the recovery period.
  - b. The 6 to 8 percent carbohydrate beverage doesn't provide enough carbohydrates to replenish glycogen stores. Some protein is also needed.
  - c. Switch to plain water. Immediately after exercise water is the only nutrient you need to consider.
  - d. Sports beverages should be consumed before and during exercise but not after exercise.
  - e. A 6 to 8 percent carbohydrate beverage contains too much sodium for the recovery period.

# Continuing Education credit



is available for this module for the following professions:

**Registered Dietitians/Dietetic Technicians: 2 CPEUs**

**Certified Dietary Managers: 2 Clock Hours**

**ACE: 0.1 CEC**

**ACE Clinical Exercise Specialists: 0.1 CEC**

**NSCA: 0.1 CEU**

**BOC: 1 CEU**

**ABMP: 1 CEU**

**OTHER: 1 CEU**

To earn credit, you must complete the examination on the preceding pages, by purchasing access to our Interactive OnLine Testing System at:

<http://www.nutritiondimension.com/>

Begin by writing down your answer choices, then visit our website:

<http://www.nutritiondimension.com/>

Click on: [Course Catalog](#)

Click on: [Nutrition Professionals](#) or [Fitness Professionals](#)

Click on: [EDnow! Modules](#)

Click on: Order number for this module: [LIQ09](#)

You will be prompted to submit personal and professional certification information, your credit card number and the Order number for this module. You will then gain an access code to complete the exam for this module.

If you have not used our online testing system before, we recommend that you review the process first by clicking on [Interactive OnLine Testing](#), and that you schedule your first testing session during our office hours (M-F, 8 am - 4:30 pm, PT), so that you can call for assistance while on-line, if necessary.

**Toll-free (US/CAN): 1-888-781-5388**

**Overseas: 011-1-541-482-4765**

**e-mail: [service@nutritiondimension.com](mailto:service@nutritiondimension.com)**