INQUIRY QUESTION
What are some performance enhancement and recovery strategies that Kimberley Brennan may have used in her preparation for winning gold in the single sculls at the Rio Olympics?
Performance enhancement and recovery strategies: psychological, nutritional and hydration

Manipulation of an athlete's nutritional and hydration needs, as well as addressing psychological strategies, can enhance performance, and aid in recovery from both training and competition.

**KEY KNOWLEDGE**
- Psychological strategies used to enhance performance and aid recovery, including sleep, confidence and motivation, optimal arousal, mental imagery and concentration
- Nutritional and rehydration recovery strategies including water, carbohydrate and protein replenishment

**KEY SKILLS**
- Evaluate a range of psychological strategies that affect performance and recovery
- Explain and apply relevant nutrition and rehydration strategies to enhance recovery

**CHAPTER PREVIEW**

Performance enhancement and recovery strategies

- Nutrition and hydration
  - Carbohydrates
  - Proteins
- Psychological
  - Sleep
  - Confidence
  - Motivation
  - Optimal arousal
  - Mental imagery
  - Concentration

Water

Sport drinks
13.1 Nutritional needs of athletes: a balanced diet

**KEY CONCEPT** Nutritional strategies are a vital component of an athlete’s diet and should be utilised in order to enhance their performance and improve their recovery.

It does not matter whether you are an international athlete, a regular club participant, or a weekend fun-runner, it is essential that all athletes consume a good balance of nutrients to supply their body with the energy needed for physical activity and to aid in recovery after exercise. Nutrition and hydration play a key role in optimising the benefits for sports performance. Appropriate nutrition is vital for all of us, not only in the choice of foods we ingest, but also with timing and quantity of foods consumed. The essential nutrients that are required by all athletes include:
- carbohydrates
- fats
- proteins
- vitamins
- minerals
- water
- fibre.

Each sport and athlete has different nutritional requirements. No set dietary regime will cater for all athletes’ individual needs. However, there is some common nutritional principles. The Australian Government’s guide to healthy eating (figure 13.1) provides a useful model that demonstrates a balanced diet.

A balanced diet is the appropriate balance of nutrients needed to supply the body with energy for physical activity and to aid in recovery after exercise.

Athletes must develop their own individual eating plans to achieve maximum results from their training programs. Not only does the athlete need to take into consideration the specific nutritional requirements of the sport that they participate in, they also need to consider their individual energy expenditure, metabolism and state of health when determining an appropriate nutritional intake. Good nutrition and hydration strategies should be practised for both training and competition. Some athletes place an emphasis on the nutrition and hydration during competition, however the intake during training is just as important.

Athletes will need to consider appropriate nutrition and hydration plans for before (pre), during and after (post) training/competition and each plan has a particular purpose.
- Pre-training/competition nutrition and hydration — aim is to keep the athlete from feeling hungry before and during exercise, and maintain optimal levels of energy stores for the activity that follows.
- During training/competition — acts as an alternative fuel source and maintains fluid lost throughout the exercise bout. Note: Some evidence suggests that top-up fuelling is beneficial for events lasting longer than 30 minutes, as the body preferentially uses glucose from the blood due to it being a faster fuel source.
- Post-training/competition — ingested in a timely manner, aims to optimise recovery following the exercise session.


**FIGURE 13.1** The Government’s Guide to Healthy Eating


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**TEST your understanding**

1. List the essential nutrients required by all athletes for a balanced diet.
2. Outline what an athlete should consider when developing their own individual eating plan.
3. Outline the general purpose of nutritional and hydration strategies before, during and after training/competition.
13.2 Nutritional needs of athletes: carbohydrates

**KEY CONCEPT** Effective carbohydrate recovery strategies are essential and play a vital role in exercise performance as carbohydrates are the most preferred and readily available source of energy to fuel working muscles.

### Carbohydrates

Carbohydrates serve many functions:
- they are the major energy fuel source for high-intensity activities
- they regulate the metabolism of fat and protein
- the nervous system relies on them for energy in order to function
- they are broken down into glycogen to be stored in the liver and muscles
- they are transported via the bloodstream in the form of glucose

### How much carbohydrate?

Any excess carbohydrate, beyond what the muscles and liver can store, is converted to fat and therefore the amount of carbohydrate that an athlete consumes has a direct impact on the amount of muscle glycogen available for training and competition. Figure 13.2 shows that athletes who consumed a high carbohydrate diet (70% of their daily intake) were able to recover their muscle glycogen storage to nearly optimum levels prior to their next two-hour training bout; whereas when the same athletes consumed a low carbohydrate diet (40% of their daily intake) they experienced accumulative decreases in muscle glycogen storage with each training bout.

The most important factor in relation to carbohydrate consumption is the amount of grams ingested.

![Figure 13.2](image)

**FIGURE 13.2** The influence of different carbohydrate diets on muscle glycogen stores during repeated days of training. Adapted from Coston and Miller 1980

A general guideline of 7–10 grams of carbohydrate per kilogram body mass (BM) is appropriate for an athlete. This can be achieved by planning meals to ensure this target level is met. Table 13.1 is a guide to carbohydrate intake for the athlete.

The carbohydrate needs of an athlete are dependent on the training and competition that they undertake. The frequency, duration and intensity of the activity session all contribute to determining an athlete’s fuel needs. These needs may change daily. On days where the athlete undertakes high activity levels, more carbohydrates should be consumed and conversely for low activity level days. Because of the importance of carbohydrate as a fuel for providing energy, athletes need to continually top up
glycogen stores by consuming carbohydrates to ensure there is enough in the muscles before the start of training and competition. Add to this the body’s limited capacity to store carbohydrates as glycogen, and you can see the importance of an athlete consuming carbohydrate before, during and after their performance in order to achieve optimal performance.

**TABLE 13.1 Carbohydrate intake goals**

<table>
<thead>
<tr>
<th>Situation</th>
<th>Recommended carbohydrate intake</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daily refuelling needs for training programs less than 60–90 minutes per day or low-intensity exercise</td>
<td>Daily intake of 5–7 grams per kilogram BM</td>
</tr>
<tr>
<td>Daily refuelling for training programs greater than 90–120 minutes per day</td>
<td>Daily intake of 7–10 grams per kilogram BM</td>
</tr>
<tr>
<td>Daily refuelling for athletes undertaking an extreme exercise program: 6–8 hours per day (cycling tour)</td>
<td>Daily intake of 10–12 + grams per kilogram BM</td>
</tr>
<tr>
<td>Carbohydrate loading for endurance and ultra-endurance events</td>
<td>Daily intake of 7–10 grams per kilogram BM</td>
</tr>
<tr>
<td>Pre-event meal (meal eaten 1–4 hours pre-competition)</td>
<td>1–4 grams per kilogram BM</td>
</tr>
<tr>
<td>Carbohydrate intake during training sessions and competition events longer than 1 hour</td>
<td>1 gram per minute or 30–60 grams per hour</td>
</tr>
<tr>
<td>Rapid recovery after training session or multi-day competition, especially when there is less than 8 hours until next session</td>
<td>Intake of 1–3.5 grams per kilogram BM for every hour in the early stages of recovery after exercise, contributing to a total intake of 6–10 grams per kilogram BM over 24 hours</td>
</tr>
</tbody>
</table>

**Application of the glycaemic index**

The glycaemic index refers to a scale that ranks carbohydrates by how much they raise blood-glucose levels over a two-hour period compared with pure glucose. Foods are ranked from 0 to 100. Foods that have a high glycaemic index (70 and above) are digested quickly, resulting in a rapid and high increase in blood-glucose levels. On the other hand, foods with a low glycaemic index (55 and less) are digested more slowly, resulting in a more gradual and less rapid rise in blood-glucose levels (see figure 13.3).

Knowledge of the glycaemic index allows athletes, coaches and sports dietitians to determine what carbohydrate foods to eat and when to eat them. Manipulated correctly, this can enable the athlete to optimise their carbohydrate availability and thereby optimally enhance their performance and recovery. Put more simply, there would appear to be times when foods with a low glycaemic index provide an advantage, and times when foods with a high glycaemic index are better. For best performance, athletes need to understand which foods have high and low glycaemic index ratings and when it is best to eat them. The athlete should use their individual experience and preference to guide their choice of pre-event meal.

It is important to understand that any food consumed is only useful once it has been digested and absorbed. The athlete should always consider their specific dietary requirements and look at the whole nutritional makeup of the food rather than just the carbohydrate component.
### 13.2 Nutritional needs of athletes: carbohydrates

#### TABLE 13.2 The nutritional classification of carbohydrates — Australian Institute of Sport

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
<th>Examples</th>
<th>Use for athletes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nutrient-dense carbohydrate</td>
<td>Foods and fluids that are rich sources of other nutrients including protein, vitamins, minerals, fibre and antioxidants in addition to carbohydrate</td>
<td>Breads and cereals, grains (e.g. pasta, rice), fruit, starchy vegetables (e.g. potato, corn), legumes and sweetened low-fat dairy products</td>
<td>Everyday food that should form the base of an athlete’s diet. Helps to meet other nutrient targets</td>
</tr>
<tr>
<td>Nutrient-poor carbohydrate</td>
<td>Foods and fluids that contain carbohydrate but minimal or no other nutrients</td>
<td>Soft drink, energy drinks, lollies, carbohydrate gels, sports drink and cordial</td>
<td>Shouldn’t be a major part of the everyday diet but may provide a compact carbohydrate source around training sessions</td>
</tr>
<tr>
<td>High-fat carbohydrate</td>
<td>Foods that contain carbohydrate but are high in fat</td>
<td>Pastries, cakes, chips (hot and crisps) and chocolate</td>
<td>“Sometimes” foods best not consumed around training sessions</td>
</tr>
</tbody>
</table>

**Source:** www.ausport.gov.au

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**Rebound hypoglycaemia** is low blood glucose followed by a rapid rise of blood glucose.

Some research indicates that there is a potential disadvantage in consuming carbohydrates before exercise. **Rebound hypoglycaemia** is when a rise in blood insulin levels suppresses the use of fat as an energy supply and makes the muscles rely more on carbohydrate for fuel. If this happens, the result is that there will also be a drop in blood glucose levels in the initial stages of exercise. Based on this theory, there is some evidence to suggest that the pre-event meal should consist of low glycaemic index ranked foods as these types of carbohydrates will prolong the use of glycogen stores and reduce the likelihood of rebound hypoglycaemia occurring.

- **Pre-exercise** meals may provide an opportunity for athletes competing in longer duration events (> 90 minutes) to increase their fuel storage.
- **During exercise** carbohydrates should be consumed regularly throughout the activity as this is an effective way to enhance endurance and performance. High glycaemic index ranked foods are recommended to be consumed during exercise as these types of foods are rapidly digested and absorbed, and therefore are more readily available as an immediate energy source.
- **Post-exercise** meals should consist of high glycaemic index carbohydrates to promote muscle glycogen resynthesis.

In more general dietary terms, athletes should aim to shift their daily nutritional choices towards consuming more foods with a low glycaemic index. There are many benefits of a low glycaemic index diet, including:

- lowered lipid (fat) levels in the blood
- assistance with weight control
- decreased risk of heart disease
- decreased risk of diabetes.

Table 13.3 below gives some examples of the glycaemic index of particular foods.

#### TABLE 13.3 Average glycaemic index of some common carbohydrate-rich foods

<table>
<thead>
<tr>
<th>Food</th>
<th>Glycaemic index (glucose = 100)</th>
</tr>
</thead>
<tbody>
<tr>
<td>High glycaemic index</td>
<td></td>
</tr>
<tr>
<td>Rice crackers</td>
<td>87</td>
</tr>
<tr>
<td>Cornflakes</td>
<td>81</td>
</tr>
<tr>
<td>Porridge, instant oats</td>
<td>79</td>
</tr>
<tr>
<td>Potato, boiled</td>
<td>78</td>
</tr>
<tr>
<td>Watermelon</td>
<td>76</td>
</tr>
<tr>
<td>White bread</td>
<td>75</td>
</tr>
<tr>
<td>White rice, boiled</td>
<td>73</td>
</tr>
</tbody>
</table>
The **Glycaemic index** weblink in your eBookPLUS also allows you to search the particular blood glucose rankings of certain foods.

Other personal factors (e.g. taste and palatability, convenience and portability, cost, ease of preparation) may also have an impact in making nutritional choices.

These will be specific to the individual and their exercise **situation**. In summary, knowledge and application of the glycaemic index can help to optimise performance and recovery. It is therefore advisable that athletes and coaches understand the different types of carbohydrates and how the body metabolises them.

### Carbohydrate gels

The following information about carbohydrate **gels** is provided by the Australian Institute of Sport through its website.

#### CARBOHYDRATE GELS

**Supplement overview**
- Highly concentrated source of carbohydrate (65–70 per cent) in easily consumed and quickly digested gel form
- Substantially more concentrated in carbohydrate than sports drinks to provide a large fuel boost in a single serve
- High cost alternative to other suitable foods and fluids, and should therefore be used only in specific situations for which they are most suited, rather than as a general snack

**Supplement profile**
- Gels deliver a substantial carbohydrate serve in a compact and easily consumed form. They may provide a practical way to carry or consume carbohydrate in a number of sports or environments.
- Some brands of gels also contain other compounds such as medium chain triglycerides (MCTs) and caffeine. Athletes should note that intake of large amounts of MCTs (e.g. > 25 grams) may lead to gastrointestinal problems.

**Situations for use in sport**
- Compact fuel source for endurance athletes during exercise lasting longer than 90 minutes, especially where it is impractical to carry large amounts of sports drinks (i.e. cyclists, triathletes)
- Compact fuel source for team sports athletes during breaks in play during extended training or competition sessions
- Compact and portable source of carbohydrate for post-exercise recovery when regular foods are not tolerated by the athlete
- Low-fibre and compact pre-event snack for athletes unable to tolerate regular foods and fluids

![FIGURE 13.4 Carbohydrate gels (continued)]
13.2 Nutritional needs of athletes: carbohydrates

(continued)

Concerns associated with supplement use
- Gastrointestinal intolerance may occur due to concentrated carbohydrate load.
- Sports gels should always be consumed with adequate fluid to meet hydration needs.
- Athletes should practice use of gels and assess tolerance during training sessions if they are intended for use during competition.
- Gels may lead to over-consumption and over-reliance on low-nutrient carbohydrate sources.

- Gels are an expensive alternative to regular food and fluid choices. This supplement should only be used for specific conditions for which it is suited, rather than as a general snack.
- Some gels contain other compounds such as medium chain triglycerides (MCTs) and caffeine. Athletes should be aware that intake of large amounts of MCTs (e.g. > 25 grams) may lead to gastrointestinal problems.

Source: Australian Institute of Sport website.

Carbohydrate gels are concentrated carbohydrates and, to be effective, they must be consumed with water. Gels provide similar benefits as sports drinks (when taken with water) and should be consumed in the same circumstances: during exercise, sports and events lasting more than an hour. Gels and sports bars taken together should be avoided when high sweat rates occur because of the large increase in carbohydrate concentration and resultant slowing of hydration rates. The use of carbohydrate gels during exercise is to supplement the carbohydrate supply for muscular activity. It is used as an immediate fuel source directly from the bloodstream to resynthesize ATP.

FIGURE 13.5 A convenient way for athletes to maintain adequate carbohydrate supplementation during performance is with carbohydrate gels and bars that have a moderate to high glycaemic index.
TEST your understanding

1  Carbohydrates are broken down into simpler forms to be transported and stored in the body. Name these forms and where they are found.
2  (a) State the percentage of carbohydrate intake recommended daily for most athletes.
(b) How much carbohydrate should an athlete consume per kilogram body mass?
3  Define the term glycaemic index.
4  Discuss how knowledge of the glycaemic index of foods can help an athlete.
5  Explain why some research suggests that foods with a low glycaemic index are more appropriate for pre-event meals.
6  (a) Identify the general ingredients of carbohydrate gels.
(b) Identify some sporting situations where carbohydrate gels may be used.

APPLY your understanding

7  Using the Eat like an athlete weblink in your eBookPLUS, listen to Michael William’s ABC radio interview with Professor Louise Burke (Head of Sports Nutrition — AIS).

(a) Explain what Professor Burke means when she says that it is a team approach to the athlete’s success.
(b) Explain what is meant by the theory of fat adaptation. What are the consequences for athletes in adopting this type of diet?
(c) Outline two important aspects about carbohydrates that Professor Burke discusses.
(d) Describe what she means by carbohydrates being ‘more economical’.
(e) Explain why Professor Burke states that carbohydrates are important for high intensity exercise.
(f) Outline why ‘one size fits all’ is a very simplistic approach to nutrition.
(g) Explain why it is important to take into account the training goals of an athlete and provide some specific examples as to different approaches to particular athlete diets.
(h) Outline how Professor Burke nutritionally prepares race walkers for their competition.
(i) Discuss Professor Burke’s underlying principles for good nutrition.

8  Consider the nutritional requirements for your particular sport and explain how carbohydrates should be appropriately incorporated into your dietary plan.

9  Practical activity: <needs title>
(a) Record your dietary intake for one day.
(b) Use the Glycaemic index weblink in your eBookPLUS to identify the glycaemic index ranking of each food and liquid item consumed.
(c) Classify each carbohydrate food item or liquid as nutrient-dense carbohydrate, nutrient-poor carbohydrate or high fat carbohydrate.

EXAM practice

10  ACHPER Trial Exam 2014, question 9
Marathon runners are often encouraged to consume both high glycaemic index (GI) foods and low GI foods. Outline the most appropriate time a marathon runner should utilise each type of GI food.  

2 marks
Protein

Protein has several important functions in the body. These include:
- muscle construction and repair
- promoting glycogen resynthesis
- playing an important role in the immune system
- facilitating the transmission of nerve impulses throughout the nervous system
- preventing sports anaemia (low iron) by promoting an increased synthesis of haemoglobin, myoglobin and oxidative enzymes.

Protein is broken down through digestion into amino acids, of which there are two types:
1. essential amino acids — cannot be made by the body, so must be consumed
2. non-essential amino acids — can be made from other amino acids in the body.

Animal foods such as meat, poultry, fish, eggs and dairy food are rich in protein and contain all the essential amino acids. Plant foods such as breads, breakfast cereals, grains, lentils, beans and peas are good protein sources, but they miss at least one essential amino acid so they should be eaten with other plant or animal sources.

Proteins can also be classified as:
- structural proteins, which are needed to build connective tissue, cell membranes and muscle cells
- regulatory proteins, which act as enzymes or transport vehicles.

Both endurance and muscle strengthening exercises stimulate muscle protein synthesis and therefore the role of protein in both type of activities is important.

How much protein?

Protein is an important part of an athlete's diet as it plays a key role in post-exercise recovery and repair. Nutritionists recommend that protein contributes up to 15 per cent of total daily food intake; however, strength and endurance athletes may require additional volume of protein for growth of muscle tissue as a consequence of their training. Most athletes would meet their daily protein requirement just through consuming a balanced diet. It has been found that additional amounts of protein are naturally ingested when the athlete increases their food intake in response to an increased training load. This is because many high-carbohydrate foods are also rich in protein; for example, bread, rice, pasta and baked beans. A guideline of 1–2 grams of protein per kilogram of body mass (BM) is recommended depending on the type of activity the athlete is participating in. Table 13.4 provides a specific guide for protein requirements for different athletes.

Research conducted at the Australian Institute of Sport (AIS) suggests it is not necessarily the increased amount of protein that can lead to gains in lean-muscle tissue, but rather the timing of the protein intake for the athlete. There is a constant balance between protein breakdown and protein rebuilding in the muscles. It is important that athletes consume foods that contain protein (amino acids) as part of their post-training or post-competition recovery process. Following intense exercise, muscle protein is actually being broken down as a result of catabolic micro-trauma due to the demands of the exercise. Consumption of protein immediately after exercise is essential in order to reverse this negative protein balance. By consuming protein post exercise, muscle uptake and retention of amino acids is enhanced and appears to
continue to be enhanced for up to 24 hours. Therefore, athletes should continue to
consume protein throughout the day as well as immediately after exercise.

**TABLE 13.4** Maximum protein needs for different groups of athletes

<table>
<thead>
<tr>
<th>Group</th>
<th>Protein intake (g/kg/day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sedentary men and women</td>
<td>0.8–1.0</td>
</tr>
<tr>
<td>Elite male endurance athletes</td>
<td>1.6</td>
</tr>
<tr>
<td>Moderate-intensity endurance athletes*</td>
<td>1.2</td>
</tr>
<tr>
<td>Recreational endurance athletes**</td>
<td>0.8–1.0</td>
</tr>
<tr>
<td>Football players, power sports athletes</td>
<td>1.4–1.7</td>
</tr>
<tr>
<td>Resistance athletes (early training)</td>
<td>1.5–1.7</td>
</tr>
<tr>
<td>Resistance athletes (steady state)</td>
<td>1.0–1.2</td>
</tr>
<tr>
<td>Female athletes</td>
<td>approximately 15 per cent lower than male athletes</td>
</tr>
</tbody>
</table>

*Exercising approximately four to five times per week for 45–60 minutes  
**Exercising four to five times per week for 30 minutes at <55 per cent VO2 max

### Protein and carbohydrates

When protein and carbohydrates are consumed together, they stimulate a greater release of insulin, which enhances amino acid uptake and promotes glucose delivery to depleted muscle cells. Research suggests that a 1:4 ratio of protein to carbohydrates is the most effective combination to support glycogen replenishment immediately post-exercise.

Insulin also plays a key role in the dynamics of protein synthesis. Insulin stimulates protein synthesis and helps to reduce protein breakdown and enhance skeletal muscle protein remodelling. Given the complementarity of these nutrients, in order for athletes to maximise their post-exercise recovery, they should ingest both carbohydrate and protein, both of which are important to rapidly restore muscle function and performance.

The consumption of protein is therefore essential on two fronts — to help boost insulin release and therefore restore muscle glycogen levels, and to provide the basic building blocks for muscle repair. Examples of good snacks that include both protein and carbohydrates include:
- yoghurt
- milk drinks
- fruit smoothies
- lean meat or cheese sandwiches.

High-protein, low-carbohydrate diets have been quite popular, but research suggests that protein consumption well above recommended intakes (>2 grams per kilogram BM) does not stimulate further muscle building or recovery and is not recommended by sports dietitians. In fact, extra consumption simply increases

**FIGURE 13.6** Foods that provide both protein and carbohydrates are excellent for post-exercise nutrition.
13.3 Nutritional needs of athletes: protein

The use of protein as a fuel and may displace other important nutrients, such as carbohydrates, from the athlete's diet. Some health risks might also be associated with excessive protein intake because of the extra demand placed on the kidneys to excrete any unused amino acids. Furthermore, excessive protein intake can compromise bone density and may also lead to weight gain if food choices are also high in fat.

**Protein supplementation**

Protein and amino acids are popular nutritional supplements used by many athletes. As previously discussed, ingestion of protein with carbohydrates immediately post exercise enhances the synthesis of glycogen and stimulates muscle protein synthesis, which is important in terms of post-exercise recovery from catabolic micro-trauma, and aids in muscle growth as part of the adaptive process. The most common forms of supplementation are protein powders made into shakes and protein bars.

It is interesting to note that current nutritional guidelines do not foresee the need for protein supplements for athletes, and research suggests supplements offer no advantage over consuming protein-rich foods as part of a balanced diet. However, athletes may require a supplement when consumption of food is difficult post exercise and products such as liquid meal supplements offer convenience and a practical solution to consuming adequate protein.

While supplements containing amino acids are popular among strength and endurance athletes, claims of their benefits remain unproven. It is important to note that excess proteins cannot be stored and are broken down and excreted — large quantities may place a significant strain on the kidneys.

The ACSM outlines specific protein recommendations in relation to resistance training (see the **Protein intake for optimal muscle maintenance** weblink in your eBookPLUS).

Sports Dietitians Australia provides some information about protein supplementation (see the **Protein supplementation** weblink in your eBookPLUS).

---

**TEST your understanding**

1. List the functions of protein in the body.
2. Protein is broken down into a simpler form to be transported and stored in the body. Name this form and where it can be found.
3. (a) State the percentage of protein intake recommended daily for athletes.
   (b) How much protein should an athlete consume per kilogram body mass?
4. Identify the best time for an athlete to consume protein.
5. Explain the benefit of consuming protein with carbohydrates post exercise.

**APPLY your understanding**

6. Create a table summarising the nutritional needs of athletes (sections 13.2 and 13.3). Include the following information:
   - transported as nutrient
   - stored as
   - common food source
   - percentage total daily intake
   - recommended consumption per kilogram body mass
   - predominant energy supply (exercise type).
7. For each of the following, provide examples of food that would assist the athlete's nutritional and energy needs.

---

(a) 100-metre sprinter
(b) Marathon runner
(c) Team sportsperson (60–90 minutes’ duration)

8. (a) Access the **Protein supplementation** weblink in your eBookPLUS to compare and contrast two different protein supplements using a Venn diagram.

(b) From your analysis, justify whether you think protein supplementation should be recommended for any particular type of athlete.
9. Use the Protein intake for optimal muscle maintenance weblink in your eBookPLUS to read the ACSM fact sheet.
(a) Explain the process of protein turnover and how it is affected by resistance training.
(b) Outline the recommendations in relation to protein intake for a person who lifts weights regularly or is training for a running or cycling event.
(c) Explain how exercising on an empty stomach affects the level of protein storage.
(d) List the suggested benefits of pre-exercise protein supplementation.
(e) Describe the role of protein ingestion following an acute bout of resistance training.
(f) Explain the roles of different types of proteins in relation to performance.

10. Practical activity: food and drink journal
Complete your own food and drink journal over a typical 24-hour period, using the example below as a guide.

   | Fluid | Nutritious carbohydrate | Meat and meat alternatives | Fat and oil | Sugar | High-fat carbohydrate | Fibre | Other |
---|---|---|---|---|---|---|---|---|
Breakfast | | | | | | | | |
Morning tea | | | | | | | | |
Lunch | | | | | | | | |
Afternoon tea | | | | | | | | |
Dinner | | | | | | | | |
Other snacks | | | | | | | | |
TOTAL | | | | | | | | |

EXAM practice

11. (ACPER Trial Exam 2012, question 12)
Protein is a vital component in an athlete’s diet.
(a) Name two foods that are a high source of protein.  
   2 marks
(b) Outline two roles that protein plays in exercise recovery.  
   2 marks
(c) Describe one situation in which protein may be used during exercise as an energy source.  
   1 mark
(d) Research indicates that using protein as an energy source during exercise may be detrimental to performance. Outline the reason for this.  
   2 marks

MY FOOD AND DRINK JOURNAL

Date: .....................

<table>
<thead>
<tr>
<th>Number of serves</th>
<th>Nutritious carbohydrate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fluid</td>
<td></td>
</tr>
<tr>
<td>Breaks, cereals and grilling</td>
<td></td>
</tr>
<tr>
<td>Vegetables</td>
<td></td>
</tr>
<tr>
<td>Fruit</td>
<td></td>
</tr>
<tr>
<td>Milk and milk products</td>
<td></td>
</tr>
<tr>
<td>Meat and meat alternatives</td>
<td></td>
</tr>
<tr>
<td>Fat and oil</td>
<td></td>
</tr>
<tr>
<td>Sugar</td>
<td></td>
</tr>
<tr>
<td>High-fat carbohydrate</td>
<td></td>
</tr>
<tr>
<td>Fibre</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td></td>
</tr>
</tbody>
</table>

Breakfast
Morning tea
Lunch
Afternoon tea
Dinner
Other snacks
TOTAL
Nutritional recovery in relation to the type of sport or activity

**KEY CONCEPT** Type and timing of food and drink consumed is extremely important and athletes must consider their post-event meals in relation to the requirements of their sport.

As athletes often train for many hours, and generally more than once a day, each meal must be considered carefully to ensure that all nutritional requirements are met and the athlete is ready to train or compete again. Athletes must avoid chronic carbohydrate depletion, as it will impair both training adaptation and competition performance. Recovery is essential for successful athletic outcomes. Athletes need to learn specific nutritional strategies to enable them to reach optimal performance levels, in both training and competition.

Athletes must strive to maintain optimal work output and avoid fatigue caused by inadequate or inappropriate nutrition. The following factors can cause nutrition-related fatigue in an athlete:

- depletion of glycogen stores
- hypoglycaemia (low blood-glucose levels)
- dehydration
- low blood-sodium levels
- gastrointestinal upset.

Athletes should undertake a nutritional strategy specific to their training or competition needs. They should also consume foods and fluids that are well tolerated, tried and tested. Their strategy must include recovery meals as well as re-hydration procedures.

**Nutritional preparation and type of sport**

If athletes are adequately fuelled and hydrated prior to and during their event then the recovery process is achieved more easily. The ability of an athlete to recover in order to perform at their optimum during their next training session or competition relies on them undertaking effective nutritional and hydration recovery practices.

**Nutritional preparation for shorter-duration sports**

As fatigue is not usually caused by glycogen depletion during high-intensity sports that last for less than 60 minutes, there is little need to fuel during the event, however there is evidence to suggest fuelling during events 30 minute plus can be beneficial as it provides the brain with food, or a feed-forward mechanism to increase rate of neural firing and thus aid in maintaining intensity and preventing fatigue. The athlete should ensure that glycogen stores are replenished afterwards so that full storage of carbohydrate is available for the next training bout or performance. Fluid replacement is the main concern and should match fluid loss. Water is adequate for short-duration activities; however, recent studies have suggested that sports drinks containing carbohydrates are useful and may be more palatable.
Nutritional preparation for moderate-intensity or intermittent sports

Intermittent or team sports lasting 60–90 minutes can be fuelled by ‘normal’ glycogen stores in most well-trained athletes.

Nutritional preparation for prolonged submaximal events

To maximise glycogen stores, endurance athletes competing in events lasting longer than 90 minutes — for example, marathons, triathlons and cross-country skiing — need to consume additional carbohydrate before the event. This process is known as carbohydrate loading.

Well-trained endurance athletes are already at an advantage because aerobic endurance training trains the muscles to store greater amounts of glycogen and to use it sparingly during aerobic exercise by increasing fat mobilisation (glycogen sparing). Carbohydrate loading can increase stores of muscle glycogen by 50–100 per cent above normal resting levels.

During the event, consumption of 30–60 grams of carbohydrate per hour, as well as fluid replacement, is encouraged.

As food consumed before exercise is only useful once it has been digested and absorbed. This means athletes need to time their carbohydrate intake so they allow time for it to be stored as glycogen and available as a muscle fuel during the exercise bout.

Fuelling during exercise

Carbohydrate and fat are the most common fuels used by athletes. Sports lasting less than 90 minutes can be adequately fuelled from stored carbohydrate and fat without the need to replenish these fuels during the actual event. However, some level of fatigue may occur and refuelling via drinks containing carbohydrate, such as sports drinks, is recommended.
13.4 Nutritional recovery in relation to the type of sport or activity

Sports that last longer than 90 minutes may benefit from the consumption of carbohydrate during the activity and high GI carbohydrates are the best to be ingested at this time. Consumption of carbohydrate can keep blood-glucose levels within 'normal' range, therefore providing extra immediate fuel sources and delaying fatigue. Sports Dietitians Australia recommends that athletes start refuelling early in the event and consume 30–60 grams of carbohydrates that have a moderate to high glycaemic index per hour to adequately refuel. Some examples of suitable foods that provide 60 grams of carbohydrates include:

- two large bananas
- one and a half sports bars
- 95 grams of jelly beans
- one jam sandwich.

The combined refuelling of carbohydrate with fluid replacement is also sound practice for athletes to follow. Carbohydration, as the practice is known, meets the refuelling requirements outlined above, and at the same time replaces any fluids lost through sweat. Commercially available sports drinks such as Gatorade and Powerade promote both rehydration and the replenishing of fuels. Athletes should strive to replace approximately 500–1000 millilitres of fluid per hour, although individual variations must also be catered for.

**TABLE 13.5** Suggested fuelling during exercise

<table>
<thead>
<tr>
<th>Type of exercise</th>
<th>Refuelling suggestion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intermittent team sports lasting 60–90 minutes</td>
<td>Recent studies have found that intermittent team sports may benefit from consumption of carbohydrate during the game as it is said to delay fatigue, prevent low blood-glucose levels and promote glycogen sparing.</td>
</tr>
<tr>
<td>Endurance events &gt; 90 minutes</td>
<td>As there is no indefinite supply of glycogen within the muscles or liver, carbohydrate refuelling is advised at a rate of approximately 30–60 grams per hour, or 500–1000 mL of a sports drink, or 10–20 jelly beans. (This is dependent on the individual athlete and will be determined following specific experimentation and consideration of environmental factors such as heat.)</td>
</tr>
<tr>
<td></td>
<td>Sports drinks, bananas, sports bars or sugar confectionery such as jelly beans are highly recommended, although ultimately it is the choice of the athlete as to which foods are most comfortable to ingest while competing.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Type of exercise</th>
<th>Refuelling suggestion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ultra-endurance events &gt; 4 hours</td>
<td>Typically these athletes compete at a lower intensity than most team sports or short-distance events. This allows digestion to take place while competing, so the athlete can consume small amounts of solid foods.</td>
</tr>
<tr>
<td></td>
<td>High-carbohydrate foods, in conjunction with small amounts of protein and fat, are advised for the ultra-endurance athlete. Muesli bars, sports or breakfast bars and jam sandwiches are a good choice for ingestion during performance.</td>
</tr>
<tr>
<td></td>
<td>Hydration must also be addressed throughout the event. Carbohydration is beneficial in these events as well.</td>
</tr>
</tbody>
</table>
Nutrition and recovery from exercise

The importance of carbohydrate and protein consumption post-exercise has already been discussed earlier in this chapter, however athletes must restore muscle and liver glycogen stores as quickly as possible, as well as rehydrate. Immediately post-exercise is when the rate of glycogen synthesis is at its greatest. The key to a speedy recovery of muscle glycogen is to eat immediately after exercise. The post-exercise period is considered to be the most critical part of nutrient timing. Consuming the proper ratio of nutrients during this time enhances the rebuilding of catabolic muscle microtrauma and restores energy reserves.

Studies have shown that an athlete should consume carbohydrate-rich foods and drinks that provide at least 1 to 1.5 grams of carbohydrate for each kilogram of body mass within 30 minutes after exercise. It does not matter if this is in the form of a full meal or just a snack. It seems that in the initial couple of hours following exercise, the muscle is more receptive to restoring greater amounts of carbohydrate. Athletes must take advantage of this time period. In addition, researchers have found that foods with a high glycaemic index may be a better choice for fast glycogen replenishment.

The main points for consideration for post-exercise nutrition include the following:

- Consuming high glycaemic ranked carbohydrates will allow for a faster absorption and resynthesis of glycogen in the muscle and liver.
- The consumption of carbohydrates should occur within the first 30–60 minutes post-exercise when the muscles are most receptive to converting glucose to glycogen.
- A high carbohydrate diet should be maintained in the 4–6 hours following exercise so as to further enhance glycogen resynthesis.
- The consumption of both carbohydrate and protein post-exercise will enhance the nutritional recovery process due to the increased presence of insulin, which stimulates muscle growth and also the uptake of glycogen into the muscle cells.
- To support the immune system.

FIGURE 13.11 Athletes commonly consume bananas in order to ‘top up’ blood glucose levels during endurance events.
13.4 Nutritional recovery in relation to the type of sport or activity

Combining carbohydrates and protein (1:4) for enhanced recovery

Carbohydrates provide a source of glucose in the blood for the recovery of fuel stores, whereas protein provides a source of amino acids for the recovery of catabolic microtrauma within the muscle cells. These two macronutrients work in synergy to enhance the recovery process. The glucose and amino acids together stimulate the production of insulin, which in turn acts as a very powerful anabolic hormone to increase the uptake of amino acids and enhance muscle recovery and growth. The combination of quick-absorbing carbohydrate (high GI) and fast-digesting protein (whey protein) sources is the best recovery combination. A protein–carbohydrate snack after exercise allows for the muscle repair and anabolic adaptation to training to occur and also the restoration of muscle glycogen levels.

High performance chocolate milk: why most sports supplements are more spin than substance

BY BRIANNA NEWLAND

Unfortunately, in their efforts to surpass the competition, product marketers have created so much clutter and mixed messaging that endurance athletes struggle to understand what product is best (or even necessary). For example, marketers have convinced athletes that leading and expensive post-exercise recovery drinks are superior to and enhance performance better than a more cost-effective chocolate milk option found at your local grocer. Rather, the truth is chocolate milk is an effective supplement for endurance athletes.

Recent exercise science research has shown that endurance athletes receive optimal recovery from nutrition with a balance of the macronutrients protein, carbohydrate and fat.

In addition to replenishing glycogen stores, endurance athletes must also consider electrolyte replacement. Until recently, Gatorade — arguably the leader in this realm — for example, has only provided the athlete with a sugary electrolyte replacement with no protein option. Gatorade’s ‘G Series’ now includes protein recovery products.

Unbeknown to most athletes, the low-fat chocolate milk option not only provides a rich source of protein, but also the valued electrolytes necessary for rehydration. But it’s not just about what athletes should be using, but also the timing for when it is consumed. The timing of consumption in order to support performance is heavily researched and debated. While this has had incredible impact in the sport science world, it can certainly add to confusion among consumers who don’t understand the science (or the debate) within the sport science community.

Recovery nutrition to support the immune system

Intensive training causes the suppression of the immune system and this continues in the hours following the training or exercise bout. During this time, athletes have a greater susceptibility to illness. Consuming adequate levels of the micronutrients vitamin C and E, glutamine, zinc and probiotics has been thought to reduce the risk of illness; however, ensuring the consumption of adequate carbohydrates before, during and after prolonged or high-intensity exercise has been found to reduce the immune system susceptibility. Carbohydrates reduce the stress hormone response and also supply fuel to the immune system white cells.

TEST your understanding
1 List the factors that can cause nutrition-related fatigue in an athlete.
2 Compare the differences in fuelling for events of differing durations.
3 With reference to the glycaemic index, identify the types of foods that should be consumed pre-event, during the event and post-event.
4 Define carbohydration.
5 Outline the role of carbohydrates in supporting the immune system during recovery.

APPLY your understanding
6 The modern pentathlon is an Olympic sport that consists of five different events: fencing, 200 metres freestyle swimming, show jumping, pistol shooting and a 3200 metre cross-country run. All events are completed in one day. Consider the specific recovery nutritional strategies Chloe Esposito may have used to perform at her optimum and win gold at the Rio 2016 Olympic Games.

8 Practical activity: diet of an athlete
Interview an athlete in a sport of your choice, preferably someone performing at an elite or subelite level, with the aim of determining whether or not they have a dietary plan designed to enhance their level of performance and recovery. Determine whether the athlete has a specific dietary plan for training, competition and/or recovery.
After completing your interview, answer the following.
(a) Assess their current dietary plan. Determine whether this dietary plan is satisfactory for optimum performance in their sport, and for their recovery from training and competition.
(b) What modifications or suggestions would you make to improve their dietary plan?

7 Practical activity: nutritional needs
(a) Select two different sports from the range of fact sheets listed on the Sports diet weblink in your eBookPLUS, providing information on nutritional recommendations.
(b) Research the nutritional needs of both of the sports selected by referring to the following:
- characteristics of the sport
- common nutrition issues
- training diet
- fluid needs
- pre-event requirements
- requirements during the event
- recovery
- other nutrition tips.
(c) Present your findings to the class in the form of two case studies.
EXAM practice

Lucy is training as a part of the women’s eight rowing crew. Her training day typically consists of the following:
- Morning, water session — 90 mins/17–20 km long steady-state rowing
- Afternoon, dry land — rowing ergometer 4 × 25 min or 3 × 7 km, medium to high intensity
- Once a week she performs a test ergometer — 30 min max or 5 km max
- 3 × week she also undertakes resistance training.

Lucy’s meal plan is below:

<table>
<thead>
<tr>
<th>Meal</th>
<th>Sample menu</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-workout (5:30 am)</td>
<td>1 apple + 2 tbsp peanut butter</td>
</tr>
<tr>
<td>Post-workout (9 am)</td>
<td>1 cup muesli + 1 banana + 1 tbsp honey + 1 plain Greek yogurt + 1 small cup peanut butter + 1 tbsp sliced almonds</td>
</tr>
<tr>
<td>Pre-workout (1:00 pm)</td>
<td>2 whole eggs + 2 oz smoked salmon + 1 whole wheat English muffin + 1 orange</td>
</tr>
<tr>
<td>Lunch (3:00 pm)</td>
<td>1 Maintain smoothie + ¾ cup cooked rice + 2 cups cooked broccoli + 1 small avocado + 4 oz chicken</td>
</tr>
<tr>
<td>Dinner (7:00 pm)</td>
<td>1 large green salad w/ 2 tbsp balsamic vinegar + 2 tbsp olive oil + 5 oz salmon + 1 cup acorn squash + 2 dark chocolate squares + 1 small plain Greek yogurt + ½ cup raspberries</td>
</tr>
</tbody>
</table>

(a) Identify one food source rich in carbohydrate. 1 mark
(b) Identify one food source rich in protein. 1 mark
(c) Outline the role of protein in recovery. 2 marks
(d) Research suggests that combining carbohydrate and protein post-exercise will enhance the recovery process. Identify the recommended ratio and discuss how combining the two macronutrients assists in the recovery process. 3 marks
(e) An athlete undertaking an intense training program may be more susceptible to illness. Explain why this may be the case and outline how carbohydrates may help to reduce the risk. 4 marks
13.5 Hydration needs of athletes

**KEY CONCEPT** Adequate hydration allows an athlete to perform at an optimal level. Depending on the type and duration of activity, water and sports drinks can assist an athlete to remain hydrated.

More than half your body weight and over 70 per cent of your body mass is water. Each day the body needs to replace about 2 litres of fluid to balance what is lost (and this is not even accounting for fluid loss through sweating!).

Fluid serves many important functions:
- to transport energy, waste, hormones and antibodies
- to dilute waste products
- to lubricate surfaces and membranes
- to help regulate body temperature
- to be involved in all chemical reactions in the body.

**Dehydration** is the result of thermoregulatory fatigue. It is vital for athletes to ensure their fluid intake compensates for sweat lost during exercise. Performance has been shown to decrease as athletes become dehydrated, and extreme levels of dehydration can lead to life-threatening problems. It is important to develop good fluid intake practices before, during and after training and competition.

How much fluid?

Sports dietitians suggest as a general guide that athletes should consume approximately 200–600 millilitres of fluid prior to their event, and that they should strive to replace approximately 500–1000 millilitres of fluid per hour during the actual event, although individual variations must also be catered for. Athletes should begin drinking early in exercise and consume small volumes (200–300 millilitres) every 15–20 minutes if possible.

Replacing body fluids lost during training or competition is an integral part of the recovery process. The amount of fluid needed to restore fluid levels may vary from 0.5 litres up to 3–4 litres, depending on how much fluid was lost during the exercise bout. In endurance exercise, as much as 6 litres, or the equivalent of 3–4 kilograms of body weight, can be lost through sweat and other mechanisms.

It is a good idea for an athlete to gain an understanding of their sweat rates during exercise so that the most appropriate hydration strategies can be followed to achieve optimum performance. It is not necessary for athletes to drink enough to prevent loss of body weight, but the amount of their dehydration should be limited to less than 2% of body weight so as not to result in a decrease in performance.

**Estimating sweat rate and loss during exercise**

- Measure body weight (kg) both before and after at least one hour of exercise. The post-exercise reading should be taken as soon as is practical after the session, and after towelling dry.
- Note the volume of fluid consumed during exercise (litres).
- Calculations: Sweat loss (litres) = body weight before exercise (kg) – body weight after exercise (kg) + fluid consumed during exercise (litres)
- To convert to a sweat rate per hour, divide by the exercise time in minutes and multiply by 60.
- Post-exercise, athletes should aim to drink about 1.2–1.5 litres of fluid for each kg of weight lost during their training or competition.
As well as water, the body also loses some electrolytes (salts and minerals such as sodium and potassium) through sweating during exercise. These electrolytes also need to be restored.

While water itself is a suitable fluid replacement and is a good choice for sports lasting less than 60 minutes, it is not always the most efficient, especially if fluid losses have been high. In this case, specially formulated sports drinks can be a better option. Provided the concentration of these dissolved electrolytes and carbohydrate is appropriate, sports drinks can actually speed up the process of absorption (gastric emptying) and the retention of water in the body. As a rule, athletes should consume these drinks as soon as possible after exercise. However, the body may take from 4 to 24 hours to completely rehydrate, depending on the exercise undertaken. It is important to note that studies have shown fluid intake increases when drinks are cool, flavoured and contain sodium.

**Over-hydration: risky business!**

Over-hydration is a serious condition with life-threatening complications and it can result from an athlete simply trying too hard to prevent dehydration. Hyponatremia (low blood sodium levels) is one of the most common complications associated with over hydration. Hyponatremia can develop from drinking too much fluid before, during, and even after the race. Inexperienced endurance athletes are generally the type of athlete most at risk of developing hyponatremia. When running at a slower pace they tend to have more opportunities to hydrate and are often naïve about the recommended fluid balance.

**Signs and symptoms of hyponatremia**

The signs and symptoms of hyponatremia are similar to those of dehydration, however thirst will precede other symptoms of dehydration and therefore should be used as the distinction between the two.

Symptoms associated with hyponatremia include:
- disorientation
- confusion
- headache
- muscle weakness
- nausea and vomiting

In severe cases, hyponatremia can progress to seizure, brain swelling, pulmonary oedema, coma, cardiorespiratory arrest or death. A 28-year-old woman died of hyponatremia after completing the 2002 Boston Marathon. Although hyponatremia is often associated with endurance athletes, any type of athlete is susceptible to the condition. A 17-year-old American high school footballer had complained of cramping during training. He had consumed 7.5 litres of water and a further 7.5 litres of Gatorade during and after training. He later collapsed at home and was taken to hospital where doctors say that he suffered massive swelling around the brain from over-hydration.

**Water versus sports drinks**

In recent years, sports drinks have become increasingly popular as a means of replenishing fluid losses after exercise. Some well-known sports drinks include:
- Gatorade
- Isosport
- Lucozade Sport
- Powerade
- Staminade
- Endura.
Sports drinks rehydrate, replace electrolytes and refuel carbohydrates.

Electrolytes are used by muscle, nerve and cardiac cells to maintain voltages across their membranes and allow electrical messages to flow across them.

The higher the carbohydrate levels in drinks, the slower the rate of stomach emptying.

Electrolytes reduce urine output, enable fluid to empty quickly from the stomach, promote absorption from the intestine and encourage fluid retention.

When considering the advantages of sports drinks, it is important to recognise that there are three different types of sports drinks available on the market, all of which contain various levels of fluid, carbohydrate and electrolytes.

**Types of sports drinks**

Table 13.6 provides a summary of the three main types of sports drinks available on the market today.

<table>
<thead>
<tr>
<th>Type</th>
<th>Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>Isotonic</td>
<td>Fluid, 6–8 per cent carbohydrate, 4–8 g of CHO per 100 mL</td>
</tr>
<tr>
<td>Hypotonic</td>
<td>Fluid, low level of carbohydrate (&lt; 6 per cent), &lt; 4 g of CHO per 100 mL (e.g. water)</td>
</tr>
<tr>
<td>Hypertonic</td>
<td>Fluid, high level of carbohydrate (&gt; 8 per cent); &gt; 8 g of CHO per 100 mL</td>
</tr>
</tbody>
</table>
### 13.5 Hydration needs of athletes

**Isotonic sports drinks**
Isotonic sports drinks are the most widely used, and are the fluid replacement drink of choice for most athletes. These types of sports drinks offer a number of advantages over plain water.

First, the carbohydrate and electrolytes (particularly sodium) in these drinks provide flavouring and taste that can increase palatability and help to stimulate consumption. Second, the sodium also aids in the retention of consumed fluids within the intracellular spaces without inhibiting the thirst mechanism. Third, the carbohydrate aids in energy replenishment — another key aspect of the recovery process.

Isotonic sports drinks have relatively the same osmolality (a measure of the concentration of all chemical particles of a solution) as the body's own blood, containing between 4–8 g of CHO per 100 mL. An isotonic drink which has 4-8% carbohydrate concentration provides a rapid delivery of fluid and fuel, and maximises the gastric tolerance and palatability for the athlete.

**Hypotonic sports drinks**
Hypotonic sports drinks act to quickly replace fluids and electrolytes lost through sweating. They have a low osmolality, containing the lowest concentration of carbohydrate and electrolyte particles. Hypotonic sports drinks are more diluted and therefore absorbed at a faster rate than ordinary water. Hypotonic drinks generally contain less than 4 g of CHO per 100 mL. They are most suitable for athletes who need fluid without the added boost of carbohydrate or electrolytes. These drinks are suitable for athletes such as jockeys who require fluid replenishment without the carbohydrate, or athletes competing in hot and humid environments where sweat losses are increased and rehydration is the main priority.

**Hypertonic sports drinks**
Hypertonic drinks are usually consumed to help meet an athlete's energy requirements during and after prolonged endurance and ultra-distance events. They have a higher osmolality than the body's own blood, which means their absorption is slower than water. They generally contain > 8 g of CHO per 100 mL. They are ingested after exercise to res synthesise muscle glycogen stores, and during exercise to top up blood glucose levels in order meet energy requirements. When consumed during exercise, hypertonic drinks should be ingested in conjunction with isotonic drinks or water to replace fluids effectively.

Sports Dietitians Australia outlines the following practical applications for consuming sports drinks.

1. **Before exercise**
   Sports drinks may be useful before an event to fine tune fluid and fuel (carbohydrate) intake. The carbohydrate in sports drinks can increase carbohydrate availability, while the added sodium may reduce urine losses before exercise begins.

2. **During exercise**
   Sports drinks are primarily designed for use during exercise lasting more than 90 minutes, by providing optimal fluid and fuel delivery. Sports drinks may allow athletes to perform for longer and more effectively in training and competition by providing energy to working muscles and the brain.

3. **Recovery**
   Sports drinks can help meet nutrition recovery goals by replacing fluids and electrolytes lost in sweat and helping to replenish glycogen stores. If there is limited time between training sessions or competition, drinks with higher sodium content may promote more effective rehydration. To meet all recovery goals, the ingestion of sports drinks should be complimented with foods and fluids that provide adequate carbohydrate, protein, and other nutrients essential for recovery.
**Are sports drinks better than water when exercising?**

**Sometimes, it depends on the individual situation.**

Should you take a bottle of sports drink down to the gym when you do that hour’s aerobicics class? Will you feel ill effects without it? And what about that Saturday soccer game?

Well, whether you would benefit from consuming a sports drink depends on the events you are taking part in and your goals, says Professor Louise Burke of the Australian Institute of Sport.

Sports drinks typically contain water and electrolytes (usually sodium and potassium) for rehydration, and carbohydrates (as sugars) for energy.

They were invented in the 1960s to replenish fluid and provide extra fuel for intense sporting activity of a long duration (more than 90 minutes).

“If you’re in the gym pedalling to lose weight while you read a magazine, then you don’t need a sports drink, just drink water,” says Burke, who runs the nutrition program for the elite athletes at the institute.

Professor Clare Collins, a spokesperson for the Dietitians Association of Australia, agrees, saying sports drinks are for serious athletes only.

“For ordinary people who play soccer on a Saturday, there’s no need for them because their fluid requirements can be met by water and generally you’re not sweating enough to lose excessive amounts of electrolytes.”

**Do you need the carbs?**

But what if you do consider yourself a committed athlete and you’re taking part in a marathon or triathlon event?

Well, Burke says the carbs in sports drinks can be helpful if you are aiming for a personal best, or taking part in a competition you really must win.

“From the physiological point of view, there’s a benefit in having carbs for sustained intense exercise, of over 90 minutes,” says Burke — who declares the AIS receives a sponsorship from a sports drink manufacturer.

This is because when we start exercising, our muscles initially use their stores of carbohydrate for fuel, but these stores become depleted after about 90 minutes.

Our muscles then start to become more reliant on fat burning for fuel. This isn’t as efficient as burning carbohydrates, so our pace is slowed.

“The intake of just three to four amounts of carbohydrate from a source during exercise, such as a sports drink, will provide an alternative or additional source of fuel to allow carbohydrate to continue to be ‘burned’ at the higher levels needed to sustain the athlete’s optimal pace,” Burke explains.

The carbs can also have a motivational effect even in shorter workouts, says Burke.

“Experiments have shown that just swilling a sports drink around your mouth and then spitting it out, can make athletes perform better.” The brain seems to become more motivated with just the promise of carbs.

**Don’t forget the sugar**

But if a sports drink can help a serious athlete, why shouldn’t we all use them?

Well, the problem is the carbohydrates (usually sugars) in the drink: one litre containing 60 grams of carbs equates to 960 kilojoules.

“We want people to be aware of the kilojoules they contain,” says Collins.

“If you are exercising to lose weight, then drinking a sports drink could mean you need to spend another 30 minutes or more in the gym.”

The American Academy of Pediatrics recently expressed concern about the carbohydrates in sports drinks, saying: “Frequent or excessive intake of caloric sports drinks can substantially increase the risk for overweight or obesity in children and adolescents.”

We should also be mindful of their effects on our teeth. Both Burke and Collins warn that, like all sugary acidic beverages, sports drinks contribute to dental erosion, so it’s important to consider this in your overall dental care regime.

Lastly, don’t confuse sports drinks with energy drinks. These often contain more carbohydrates than sports drinks as well as stimulants like caffeine.

So, when you’re deciding whether to choose water or a sports drink, here are some guidelines.

**Use water:**

- when exercising to lose weight
- when exercising for an hour or less.

**Consider using a sports drink:**

- for fuel when doing intense sustained exercise for 90 minutes or more. You need at least 30 g carbs/hour.
- when the outcome of a competition is important to you and you need to perform at your best. Using small amounts every 10–15 minutes can make you feel like working harder.

Professor Louise Burke of the Australian Institute of Sport and Professor Clare Collins of the Dietitians Association of Australia spoke to Clare Pain.

Source: www.abc.net.au

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**The use of intravenous drips in rehydration**

For many years, **intravenous (IV) hydration** has been used in sport to medically assist athletes suffering from severe dehydration. In 2003, Belgian tennis player Justine Henin-Hardenne (figure 13.14) won the US Women’s Open after spending part of the previous night on an IV drip. This was considered necessary to reverse the dehydration she suffered during her three-hour, three-set victory over Jennifer Capriati in the semi-final the night before.

During the 2001 AFL season, the Brisbane Lions made headlines with their use of IV drips at halftime to rehydrate players during matches. The AFL banned the use of IV drips some 18 months after the Lions first started using the procedure.
13.5 Hydration needs of athletes

In 2005, the World Anti-Doping Agency (WADA) included IV infusions on their list of prohibited substances and methods. They can only be legally administered if medically required and authorised.

Standard IV fluids provide saline (water and sodium) in various concentrations and, sometimes, a low level of glucose. In medical practice they are used to correct fluid, electrolyte and carbohydrate deficits in people who are unable to do this normally by eating and drinking (e.g. if unconscious or suffering severe vomiting or diarrhoea). Some athletes who have used IV drips after exercise bouts claim that it makes them feel better and helps them to recover more quickly. However, many medical experts dispute that this is anything more than a placebo effect. They counter that the main benefits associated with IV drips are the novelty and attention, and being forced to lie still for one to two hours after an event. Apart from the possible psychological benefit from using an IV drip during recovery, there may in fact be some practical advantages as well.

Athletes often experience difficulties in juggling the need for adequate recovery, refuelling and rehydration during busy competition schedules. With an IV drip the athlete can be given a known amount of fluids and carbohydrate, and be ‘consuming’ these while resting, or even sleeping. Furthermore, some athletes find it difficult to orally ingest the amounts of fluids and foods that are recommended as part of the recovery process immediately post exercise. IV drips overcome these problems by delivering a specified volume of fluids and a concentration of nutrients directly to the bloodstream.

However, it is also possible that IV fluid replenishment is not as effective as the more conventional method of simply drinking liquids. Research has demonstrated no discernable advantage for IV compared with oral rehydration. The data also suggested that oral fluid replacement might provide a performance advantage, reduce the subjective perception of thirst and make exercise feel easier. Additional research is needed to further characterise these differences.
TEST your understanding
1. (a) As a general guideline, state how much fluid sports dietitians recommend an athlete should consume before, during and after an exercise session.
   (b) Why is this different for each individual athlete?
2. Define the term sports drink.
3. (a) What is meant by the term hyponatremia?
    (b) List the symptoms associated with hyponatremia.
4. Explain the underlying rationale behind the use of IV drips as a means of rehydrating athletes after competition or training.

APPLY your understanding
5. Explain why sports drinks are sometimes the preferred source of rehydration in comparison to water.
6. Compare each type of sports drink and include the following information:
   - type
   - carbohydrate concentration
   - type of athlete suited to
   - other considerations.
7. For each of the following people, suggest what type of hydration would be best.
   (a) Mum who walks for 30 minutes with pram around local creek to maintain weight and fitness.
   (b) Local footballer who goes to the gym four times a week to work on his strength and power via a weights program.
   (c) Elite netballer who trains five times a week, consisting of approximately 100 km each day.
   (d) Weight lifter who trains every day but needs to monitor weight prior to competition.
   (e) A road cyclist competing in a multi-day event consisting of approximately 100 km each day.
8. Read the article ‘Are sports drinks better than water when exercising and answer the following questions?’
   (a) Explain why sports drinks were originally invented.
   (b) Describe the types of activities where water is the recommended hydration method.
   (c) Describe the types of activities where sports drinks are the recommended hydration method.
   (d) Discuss how sports drinks can have a motivational effect on an athlete’s performance.
   (e) Explain why sports drinks are not recommended for the average person.
9. Practical activity: fluid intake
   Monitor your fluid intake over three days.
   (a) Weigh yourself and calculate your recommended daily fluid intake (40 millilitres per kilogram of body weight = millilitres of fluid to be consumed daily).
   (b) Include in your report any exercise or exertion that requires extra rehydration.
   (c) Explain your adherence to, or departure from, the correct hydration habits, and suggest how you could improve this aspect of your lifestyle.
10. Practical activity: sports drinks and energy drinks
    Visit a supermarket and look at the range of sports and energy drinks available.
    (a) Record the available sports and energy drinks according to the following categories: isotonic, hypotonic, hypertonic and energy drinks.
    (b) Analyse these products in terms of their main ingredients (including percentage concentrations) and any claimed benefits of each drink.
    (c) Present your findings as a written report.

EXAM practice
11. (ACHPER Trial Exam 2014, question 9)
    This year, in October, thousands of runners will compete in the annual Melbourne Marathon.
    Hyponatremia is a very real, yet often ignored, hydration problem. Many factors can lead to hyponatremia, one of which is consuming too much water.
    (a) How does hyponatremia affect performance in a marathon? 2 marks
    (b) Identify and briefly explain one strategy that could help to prevent hyponatremia. 2 marks
12. (ACHPER Trial Exam 2011, question 7)
    A class of Year 12 students undertook a Cycle-Spin class at the local gymnasium. This class consisted of 45 minutes of continuous cycling mixed with random bursts of speed. During the class, the instructor varied the intensity of the movements and instructed the students to increase or decrease the resistance on their stationary bikes. The session included a five-minute warm-up and a five-minute cool-down that included stretching.
    The 45-minute Cycle-Spin class was held indoors. Despite the use of fans, the temperature inside the room was 30 degrees Celsius. Following the class students drank fluids.
    i. Which type of fluid would maximise the students’ recovery immediately after the class?
       A. Water    B. Hypotonic drink
       C. Isotonic drink    D. Hypertonic drink 1 mark
    ii. Justify your choice. 2 marks

CHAPTER 13 • Performance enhancement and recovery strategies: psychological, nutritional and hydration 483
13.6 Psychological strategies to enhance performance and aid recovery: sleep, confidence and motivation

**KEY CONCEPT**  Sleep, confidence and motivation are very important for an athlete to perform successfully. Setting goals and understanding the reasons for participating in activity will assist an athlete to achieve optimal performance.

Sports psychology is the sports science that seeks to understand psychological and mental factors that affect performance in sports, physical activity and exercise, and apply these to enhance individual and team performance.

Sports psychology is so important to performance at the top level of sport that most elite sporting clubs and individuals now employ sports psychologists to work with them.

The work of sports psychologists tends to focus on techniques that athletes can use in competitive and training situations to maintain control. Psychological skills training (PST) helps athletes make adjustments to their actions, thoughts, feelings and physical sensations. It should be an integral part of an athlete’s overall training program and preparation.

The following factors are vital in allowing an athlete to be at their psychological peak:
- quality and quantity of sleep
- self-confidence
- motivation
- optimal level of arousal
- focus (mental imagery)
- concentration.

For an Olympic athlete like Cate Campbell, who has dedicated years of training to her swimming, the difference between success and failure comes down to just a few seconds. There is immense pressure for Olympic athletes and any other elite athlete to perform at their best at the right time. In Cate’s case, the right time was a 52-second time period in the 100 m freestyle final at the Rio Olympics. Despite already winning one gold (4 x 100 m freestyle) and one silver (4 x 100 m medley), the expectation was that she would win gold in the individual 100 m Freestyle event; however, she placed fifth.

The world got to witness possibly the greatest choke in Olympic history a couple of nights ago, Cate Campbell after her 100 m Freestyle loss at the Rio Olympics.

The role of sports psychology is to help athletes like Cate develop strategies that enable them to manage the pressures and enhance their performance.

Use the Sports psychology and improving performance weblink in your eBookPLUS, to hear Professor Martin Hagger from Curtin University explain the importance of sports psychology in enhancing sports performance. He discusses some specific examples of athletes and how they use psychological strategies for their particular sport.

**Sleep**

Sleep and rest are essential for gaining the anabolic effects of training. Sleep plays an important role in:
- tissue growth and repair
- immune function
- allowing the brain to rest and recharge.

Sleep is essential for an athlete’s recovery and performance. Lack of sleep can have psychological effects on the body. It can lead to the athlete functioning at a less than optimal level via reduced:
- visual processing ability
- concentration.
Sleep & Sports Performance
How a good night’s sleep can improve your athletic attributes

Being in-shape is key to performance, and the numerous studies into sleep deprivation and obesity have established a link between the two—those who sleep the least tend to be more obese. Sleeping well makes eating the right foods a much easier task—lack of sleep increases cravings for high-calories junk food, as well as decreasing how much your lifestyle dictates your weight, as opposed to your genetics.

NASA found that the alertness of their pilots improved by 54%, and their overall performance by 34% in the hours following a 26 minute nap, which NASA also identified as being the optimum nap duration.

The quality of your night’s sleep can significantly influence your physical and mental energy levels the next day—research shows that the perceived level of physical exertion during exercise significantly increases when subjects are sleep deprived, decreasing one’s capability to push themselves to the maximum.

Sleep facilitates the production of human growth hormone (HGH) which repairs damaged muscles. Getting a good night’s sleep allows your body to fully recover from a work-out or training, maximizing your preparedness for the next day’s exercising and helping to alleviate any potential injury problems. Netherlands star Wesley Sneijder believes that some of his teammates’ injuries have been due to giving up on a strict training regime.

Both quantity and quality of sleep are very important. Athletes are encouraged to view their sleeping habits in the same way they would their training habits. Establishing a pre-sleep routine is very important. Sports psychologists agree that sleep hygiene is essential for athletes to benefit from a good night’s sleep. The following are all imperative to quality sleep:

- a conducive sleeping environment (comfortable bed, well-ventilated room)
- switching off from the day’s activities
- slowing down the functioning of the brain
- going to bed when you are tired
- avoiding screen time close to bed time
- avoiding stimulants (caffeine or alcohol)
- not consuming a large meal directly before bed and allowing four hours after a meal before sleep.

Relaxation techniques such as progressive muscle relaxation, centred breathing and meditation are all ways to assist with winding down before bed.

Furthermore, it is interesting to note that studies have shown that sleep is thought to contribute to memory and that a certain amount of sleep is required to consolidate learning of motor skills and therefore improvements.

Sleep hygiene is the routine that an individual goes through before falling asleep.

Research carried out by the University of Stanford found that when their women’s tennis team extended their sleeping time to ten hours per night for five weeks, they were able to hit more accurate tennis shots, as well as improving their sprint times.

There is a positive correlation between sleep quality and proneness to anxiety and depression. Being motivated is the first step on the journey to peak athletic condition, and sleeping well can help avoid giving up on a strict training regime.
Confidence

Confidence is a belief an athlete has about their ability to execute a specific task or goal successfully. The athlete will have self-confidence if they believe they can achieve their goal. When an athlete has self-confidence they will:

- persevere even when things are not going to plan
- show enthusiasm and motivation
- be positive in their approach and take their share of the responsibility in success and failure

Self-confident athletes:

- believe in themselves and their skills
- exhibit positive emotions
- remain calm under pressure
- think more positively
- have a greater ability to follow, understand and execute game plans.

An athlete's level of confidence is considered one of the key influencing factors that will differentiate between a successful and an unsuccessful performance.

Confidence can be lost when athletes start focusing on things that are outside their control, such as other competitors' performances, or become overly critical of their own individual performance. In sporting terms, this is often referred to as choking. As well as attentional changes such as loss of confidence or focus, choking can also include physical changes including increased heart rate, breathing rate and muscle tension. The athlete may have performed the skill many times before, but their anxiety about performing the skill correctly and under pressure can result in impaired performance. This often occurs at crucial times in an event and can result in:

- an increase in negative self-talk
- poor judgement and decision making, leading to poor skill selection
- a decrease in selective attention and an inability to attend to relevant cues
- rushing and not taking the normal preparation time for skill execution
- a decrease in coordination and timing due to increase in muscular tension.
The Australian Sports Commission says that an athlete will have confidence in an activity by:
- knowing what to do
- knowing how to do it
- knowing when to do it
- having the resources and ability to do it
- wanting to do it.

and that athletes can build confidence by:
- working hard at training
- practising good self-management
- rewarding themselves when successful
- recording/logging their successes.

“I stopped listening to music pre-game because I felt it got me too wound up and I tried some different things... I don’t think I have an ego, but I’m certainly confident in my ability and I feel like I can be a good player and I want to achieve what I feel like I am capable of achieving.” — Jack Viney

**FIGURE 13.15** Jack Viney (Melbourne Football Club) attributed some of his improvement in his performance to working with a sports psychologist.

**Motivation**

Successful sports performance depends on the athlete being fully committed and motivated towards achieving their goals. **Motivation** may be defined as ‘the causes of the initiation, maintenance and intensity of behaviour’. In other words, motivation is a reason for participating in an activity, learning the skills involved, training and practising, and dedicating effort to improvement. It is also linked to the satisfaction gained from participation and from achieving ambitions. Motivation can also be described as the driving force behind an athlete’s desire and determination to achieve their goals.

Athletes with high levels of motivation often exhibit the following characteristics:
- a desire for success
- a willingness to take risks
- an acknowledgement of their own ability as crucial to their success
- an ability to increase their effort and concentration as the task difficulty increases.
Athletes who do not have this level of motivation are less likely to perform successfully and less likely to achieve elite levels. Therefore, coaches have been greatly concerned with what optimally motivates athletes. One of the most widely used methods of achieving this is through the use of goal setting.

**Goal setting**

Goal setting is an extremely effective motivational technique. However, to be a successful tool, goals must meet the following criteria based on the acronym SMARTER:

- **Specific** — athletes and coaches should make their goals as specific and detailed as possible.
- **Measurable** — goals should be measurable and assessed against a standard or previous performance, otherwise there is no way of determining whether or not they were achieved.
- **Accepted** — all of the parties involved in the setting of the goals (e.g. the athlete, coach, manager, family members) should accept them.
- **Realistic** — goals need to be challenging, but also achievable. Goals should be framed in a positive manner and focused most importantly on improvement, rather than just on winning.
- **Timeframed** — short-term and long-term goals should be set and there should be a specific date for when they will be achieved.
- **Exciting** — the goals set should challenge, excite and inspire the athlete.
- **Recorded** — the agreed goals should be recorded by the coach and the athlete so as to provide a constant reminder and to act as a source of motivation.

Goals can also be categorised as:

- **Outcome goals** — which are related to the overall results of a competition; for example, a golfer winning a tournament or their ranking compared to other golfers.
- **Performance goals** — which are related to the athlete's own personal level of performance irrespective of others. For example, a golfer may analyse their game and aim to improve from hitting 50 per cent of the greens in regulation to hitting 60 per cent of the greens in regulation.
- **Process goals** — are related to performance goals, however they are the physical movement or game strategy aspects that the athlete focuses on. For example, in addition to setting a performance goal of increasing the number of greens hit in regulation by 10 per cent, a golfer may also develop a set routine to perform before every shot.

**Intrinsic and extrinsic motivation**

Motivation may be either *intrinsic* or *extrinsic*.

- **Intrinsic motivation** comes from within and occurs when factors such as enjoyment, satisfaction, improvement and enhanced feelings of self-worth are the primary motivation for performance.
- **Extrinsic motivation** has an external focus and usually involves some form of material benefit such as financial reward (prize money), awards and trophies, glory and recognition. Most researchers agree that intrinsic motivation to perform is more desirable than extrinsic motivation, as it will serve as a more powerful and sustainable source of motivation.
TEST your understanding

1. Outline the importance of sleep for an athlete.
2. Explain what is meant by the term sleep hygiene.
3. Define confidence.
5. Describe ways an athlete can improve their confidence.
6. Define the acronym SMARTER and what it relates to.
7. Outline the difference between intrinsic and extrinsic motivation. Provide examples.

APPLY your understanding

8. Select a sport of your choice and apply the SMARTER principle for goal setting.
9. Develop a specific ‘good sleep guide’ for an athlete of your choice. Consider the training requirements of the sport that they participate in, e.g. swimmers may train at 5 a.m.

EXAM practice

10. (adapted from ACHPER Trial Exam 2013, question 4)

At the 2013 Australian Tennis Open, Belarusian Victoria Azarenka played American teenager Sloane Stephens in her semi-final match. Azarenka won the first set, 6 games to 1. In the second set at 5 games to 3, Azarenka served for the match five times but was unsuccessful. Eventually, after two medical time-outs that took Azarenka off the court for seven minutes, she came back to win the match 6–4 in the second set.

Azarenka told an on-court interviewer immediately after the match: “Well, I almost did the choke of the year … at 5–3, having so many chances I couldn’t close it out.”

(a) Azarenka believed she almost choked. Define choking. 1 mark
(b) List two physical changes that are likely to occur when a player ‘chokes’. 2 marks
(c) Explain how one of the physical changes you have listed in (b) will affect performance. 2 marks
(d) Explain one psychological strategy that Azarenka’s coach could introduce into her training routine to prevent ‘choking’ from occurring again. 2 marks
KEY CONCEPT  An athlete’s arousal level and concentration while participating in physical activity can affect their ability to succeed. Strategies that focus on maintaining these can optimise performance.

Maintaining control

An athlete's ability to maintain control of their emotions in the face of pressure or adversity and remain positive is essential to successful performance. Performance (or competitive) anxiety and arousal levels are two emotional control factors that can impact on performance.

Performance anxiety

Anxiety can be defined as a maladaptive emotional state that is typically associated with heightened arousal and the interpretation of a situation as threatening and/or dangerous. Performance or competitive anxiety can cause athletes to react both physically and mentally in a manner that can negatively affect their performance. Performance anxiety can manifest itself in two ways:

1. physical (or somatic) anxiety — butterflies, sweating, nausea, needing to go to the toilet
2. mental (or cognitive) anxiety — worrying, negative thoughts, confusion, lack of concentration.

A range of psychometric tests or sport anxiety questionnaires (SAQ) have been used by sports psychologists to understand and measure competitive anxiety. The Sport Competition Anxiety Test (SCAT) is one such test (see figure 13.17). To help the athlete control competitive anxiety a range of somatic techniques, such as progressive muscle relaxation, and cognitive techniques, such as mental imagery, can be used (these will be discussed in some detail later in this chapter).

Factors that can affect an athlete's level of anxiety include:

- the importance of the event or competition — the more important the event is, for example, a grand final, the more likely the athlete will experience anxiety.
- level of spectator support — studies have shown that the 'home ground advantage' does occur and teams are more likely to win when playing at their home venue. This occurs not only for team sports but also for major events such as the Olympic games as seen with the record-breaking number of medals won by Australia in Sydney 2000.
- individual sports versus team sports — competitors of individual sports generally suffer more anxiety than competitors in team sports due to the sense of isolation and increased exposure.
- expectation of success — individuals and teams can be affected by the expectation that they will win; such an expectation can increase an athlete's level of anxiety. An example of this was the Australian Women's 4 × 100 m freestyle swim team who were hot favourites to win gold at the Rio Olympics.
### Sport Competition Anxiety Test (SCAT)

**ASSESSING YOUR ANXIETY**

Read each statement below and decide if you ‘Rarely’, ‘Sometimes’ or ‘Often’ feel this way when competing in your sport. Tick the appropriate box to indicate your response.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Rarely</th>
<th>Sometimes</th>
<th>Often</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Competing against others is socially enjoyable.</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>2. Before I compete I feel uneasy.</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>3. Before I compete I worry about not performing well.</td>
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<tr>
<td>4. I am a good sportsman when I compete.</td>
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<tr>
<td>5. When I compete, I worry about making mistakes.</td>
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<td>6. Before I compete I am calm.</td>
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<tr>
<td>7. Setting a goal is important when competing.</td>
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<tr>
<td>8. Before I compete I get a queasy feeling in my stomach.</td>
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<tr>
<td>10. I like to compete in games that demand a lot of physical energy.</td>
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<tr>
<td>12. Before I compete I am nervous.</td>
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<tr>
<td>13. Team sports are more exciting than individual sports.</td>
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<tr>
<td>14. I get nervous wanting to start the game.</td>
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<tr>
<td>15. Before I compete I usually get uptight.</td>
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</tbody>
</table>

**Athlete’s Name ___________________________**

**SCAT Score**

Less than 17 You have a low level of anxiety.
17 to 24 You have an average level of anxiety.
More than 24 You have a high level of anxiety.

**Analysis**

The score for the response to each question is detailed below. Enter the score for each question in the ‘Athlete’s score’ column and then total the column to provide a SCAT score.

Note that questions 1, 4, 7, 10 and 13 score zero regardless of the response.

<table>
<thead>
<tr>
<th>Question No.</th>
<th>Rarely</th>
<th>Sometimes</th>
<th>Often</th>
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<td>1</td>
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<td>15</td>
<td>1</td>
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<td>3</td>
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</tbody>
</table>

**SCAT Score**

Less than 17 You have a low level of anxiety.
17 to 24 You have an average level of anxiety.
More than 24 You have a high level of anxiety.

**FIGURE 13.17** Sport Competition Anxiety Test (SCAT)
**Arousal and performance**

Arousal in sport can be defined as the degree of activation (both physiological and psychological) that an individual experiences when faced with a sporting situation or task. It can be viewed as a continuum ranging from drowsiness/sleep to a psyched-up, hyperactive state.

In the field of sports psychology, many models have been created to explore arousal levels as they relate to athletic performance. These models include:

**Drive theory**

According to drive theory, if an athlete is appropriately skilled then it will help them to perform well if their drive to compete is aroused (i.e. they are ‘psyched up’).

**Inverted-U hypothesis**

The inverted-U hypothesis predicts that the relationship between arousal and performance approximates an inverted-U shape (see figure 13.18). The theory is that as arousal increases performance improves, but only up to a certain point (top of the inverted U). If the athlete’s arousal is increased beyond this point then performance diminishes. A moderate degree of arousal is seen as being optimal to performance.

**Optimum arousal theory**

According to the optimum arousal theory, there is substantial individual variability in arousal–performance relationships. Each athlete will perform at their best if their level of arousal or competitive anxiety falls within their optimum functioning zone. Some athletes perform best under conditions of high arousal, some when arousal is moderate and some when it is low. To maximise performance, an athlete needs to find their optimal level of arousal.
Techniques to decrease arousal levels
Arousal reduction techniques include the following:

**Progressive muscle relaxation (PMR)**
Athletes undergo a series of exercises that lead to progressive muscle relaxation and eventually total body relaxation. This technique is based on the simple premise of tensing (tightening) one muscle group at a time, followed by a release of the tension. Through repetitive practice athletes quickly learn to recognise and distinguish between the associated feelings of a tensed muscle and a completely relaxed muscle. With this simple knowledge, they can then induce physical muscular relaxation at the first signs of the tension that accompanies over-arousal and associated anxiety. This physical relaxation can then help to induce a state of mental relaxation and calmness in many situations.

**Controlled breathing**
The technique of controlling and slowing down breathing to release tension and anxiety can be used before or during performance. This technique helps the athlete to focus while they are preparing for the next action.

When an athlete experiences over-arousal, one of the first things that is disrupted is their breathing. It becomes short and sharp and they are therefore unable to deliver a sufficient amount of oxygen to their muscles in order to perform at their best. Controlled breathing ensures that enough oxygen can be taken up, which ultimately relaxes the athlete and provides them with a greater sense of control. It will also give the athlete a greater level of confidence and enable them to more easily combat negative thoughts.

Controlled breathing involves taking smooth, slow and regular breaths. Sitting upright or standing allows the athlete to increase the capacity of their lungs.

An example of a process for controlled breathing:
1. Take a slow, deep breath in through the nose, breathing into the lower abdomen — approximately 4–5 seconds.
2. Hold breath for 1 or 2 seconds.
3. Exhale slowly through the mouth — approximately 4–5 seconds.
4. Wait 2 seconds and start again.

Repeat the process until arousal levels have reduced to optimal levels.

Controlled breathing is particularly beneficial for activities and sports that require significant concentration and focus, such as taking a free throw in basketball or a penalty goal in soccer. Controlled breathing will help athletes to maintain their composure in high-pressure situations. They are better able to read their environment if they are calm and relaxed. They will be more able to focus on relevant cues and ignore irrelevant and distracting ones, which is essential in performing well and achieving success.

**Meditation**
Meditation involves focusing the mind on a particular thing for a certain period of time. It can involve using a mantra (repeating a calming word or sound), or using blank meditation. Meditation is used to help reduce stress before an event. The aims of this technique are to calm the mind and relax the body.
13.7 Psychological strategies to enhance performance and aid recovery: optimal arousal, mental imagery and concentration

Four reasons why every athlete should meditate

ARTICLE BY DR. KRISTIN KEIM (CLINICAL SPORT/PERFORMANCE PSYCHOLOGIST) FOR THE HEADSPACE APP.

“Bike racing is always physically hard, but the mental part can be even harder.”

Just the other day an athlete posted this on social media, and they’re right. A mind that is not under control is a mind that makes mistakes — mistakes that could prevent you from winning. High levels of stress decrease your ability to maintain focus and concentration. Of course, stress can be a helpful tool when used correctly; but when it’s not, it can not only impact your performance, but your life. As a clinical sport psychologist I have worked with a vast array of elite, professional and amateur athletes. Despite their differences in level and/or sport, they all face similar challenges: anxiety, depression, stress, inability to maintain focus, sleep difficulties, lifestyle balance, confidence, the list goes on. But so does the game. So when my athletes need to step up but are having trouble finding the mental where withal, one of the key techniques I rely on to change their thoughts and behaviours is meditation.

Why should you consider practicing meditation for athletic performance?

1. Stress reduction
Stress reduction is vital for optimal performance. Racing and competing when under stress has been proven to negatively impact athletic performance. A study published in the Journal of Health Psychology showed that the results of meditation are associated with reduced stress levels in addition to decreased levels of the stress hormone cortisol. Being relaxed and centred increases the ability to remain calm under pressure and also improves focus and concentration. By consistently practising meditation, your body will learn how to relax in stressful situations, building self-confidence and ultimately achieving a more positive mindset.

2. Improved sleep patterns and speeding recovery time
Sleep is imperative to all human beings, especially athletes. A study published in the Journal of Sleep showed that athletes who are not able to get enough sleep will experience a number of negative effects, including weight gain, mood disturbance, increased anxiety and tension, inability to maintain focus, concentration and decreased motor control. Athletes who consistently practice meditation can help their body to recover quicker from training, racing and even injury. While physical training is good, it also places high levels of stress on the body, including muscle fibre tears. Recovery time from many common sports injuries can actually be reduced. In addition, meditation boosts the immune system, preventing illness that can hinder your training and/or performance. Researchers from the University of Wisconsin School of Medicine and Health found that those who practise meditation experience fewer acute respiratory infections, as well as a shortened duration and severity of symptoms from the common cold. Therefore, meditation aids in improving the quality/length of sleep and the immune system.

3. Enhanced endurance
This might be one of the most popular reasons to include meditation into your training routine. By practising meditation that utilises visualisations, athletic endurance can be enhanced. Athletes who visualise accomplishing specific objectives/goals, combined with the regular practice of breathing exercises, can train the body to work harder and for a longer period of time in training and competition.

4. Improved sense of identity, self and the body
Meditation in sport can help athletes conquer those common "blind spots" that tend to make performance challenges seem worse than they actually are. These blind spots negatively impact performance, and meditation helps you recognise your blind spots. By recognising these blind spots, you can work on improving your physical/mental training, skills and coping mechanisms. This serves to build your athletic identity and self-confidence, and improve performance. Furthermore, the meditator learns to enhance awareness of each muscle, which can help pinpoint an injury and prevent further damage. Finally, meditation in sport can greatly improve the mind-body connection, allowing you to discover your optimal zone of performance.

Meditation in sport is not only helpful for performance, but can also aid athletes who experience anxiety, depression and other mental health illnesses. The practice can help athletes through injury, as well as to overcome challenges such as the transition back into sport or out of sport (e.g. retirement).

The practice of meditation is a journey similar to that of any athletic pursuit, and it could offer that small percentage needed to make you a better athlete and a happier human being.

Source: www.headspace.com

Biofeedback
Athletes can learn to recognise cues that inform them of their readiness for competition. These may be physical indicators such as heart rate and breathing rate, or mental cues such as attention and concentration levels.

Biofeedback is a process for monitoring information about physiological functions that are controlled by the autonomic nervous system. The data generally analysed are heart rate, blood pressure and respiration responses. Biofeedback is essentially a training and coaching tool that provides information to the athlete about their physiological responses, which enables them to acquire some skills that enhance the relationship between their physical and mental performance.
For example, for a long jumper who repeatedly commits a foot fault, the coach will use biofeedback such as heart rate responses to identify the precise moment of heightened anxiety and tension that the athlete feels during the jump sequence. The coach will then use this information to help the athlete in developing an appropriate psychological strategy to maintain a consistent level of arousal throughout the jump.

**Stress inoculation training (SIT)**

Stress inoculation training involves an athlete being exposed to increasing levels of stress, building up to levels similar to those imposed during competition or games. This process allows the athlete to gradually develop their ability to cope with the heightened pressure of competition and enhance their overall performance. This technique helps the athlete to learn to prepare for any stressors, control their responses to the stressors and maintain their focus. It is a way of developing an athlete's immunity to stress.

There are three stages of SIT:

1. The conceptualisation stage: an awareness of positive and negative thoughts
2. The rehearsal stage: learning to use coping strategies such as positive self-talk and imagery
3. The application stage: practising the coping strategies initially in low-stress conditions and gradually progressing to high-stress situations.

**Techniques to increase arousal levels**

Arousal promotion techniques include the following:

**Elevated breathing rate**

Taking short sharp breaths can trigger the central nervous system into an increased state of awareness.

**Act energetic**

Increasing an athlete's physical intensity and 'pumping themselves up' when they are feeling particularly low helps to increase their arousal levels; for example, Lleyton Hewitt's famous 'C'mon!'.
13.7 Psychological strategies to enhance performance and aid recovery: optimal arousal, mental imagery and concentration

Positive self-talk
Athletes can increase their arousal levels by repeating positive self-statements/affirmations (for example, ‘I am feeling fit and strong’, ‘I am ready to go’, ‘I can do this’). They can also use cue words to remind them of what they need to concentrate on in order to remain focused.

Energising imagery
Athletes may visualise something that is uplifting to help them increase their arousal levels; for example, crossing the finish line in a 100 m sprint or kicking the ball through the goal posts in Australian Rules football.

Use of music
Music is a common strategy used by athletes in many sports to control their arousal levels. Music has a profound physical and emotional impact with the ability to make an athlete feel inspired and motivated.

Pre-competition workout
Athletes raise their arousal levels to desired performance levels before competition through the use of warm-up exercises such as shadow boxing, motivational addresses, music and video footage.
Mental imagery (visualisation)

Mental imagery or visualisation is one of the simplest and most tried-and-true methods for psychologically preparing athletes to perform. Mental imagery involves athletes visualising themselves performing a skill or competition event flawlessly, such as sinking a putt in golf or successfully throwing a free throw goal in basketball.

There are a variety of techniques that involve the use of mental imagery:
- mental practice — used for a specific movement or skill, such as a penalty kick in soccer.
- mental rehearsal — used for a complete athletic performance. The athlete must create as detailed an image as possible, and visualise themselves performing flawlessly in a game environment.
- mental review — used to recount a past performance. It is important for the athlete to learn from any negative aspects, yet move past them to focus on positive results.
- self-affirmation — used to improve self-confidence by imagining successful performances.

Simulation and mental imagery should be used together for maximum effect. Simulation is achieved by making the physical training environment as similar as possible to game demands (a dress rehearsal). It is similar to the principle of specificity but with a psychological focus. Simulation training works on the theory that athletes will learn to concentrate effectively in actual situations if they have trained in situations that are similar. This may involve an athlete training in the same venue as the competition venue or incorporating match play with opponents into their training regime.

Visuo-motor behaviour rehearsal (VMBR) utilises a combination of a number of psychological strategies.
- It is comprised of three main phases:
  1. Optimal arousal phase
  2. Visualisation/mental imagery phase
  3. Performing/simulation phase.

Concentration

Concentration (or attention) is the mental ability to focus on the task at hand while ignoring distractions. The capacity to ‘concentrate’ is widely regarded by athletes, coaches and sports psychologists as one of the keys to successful performance in sport. Coaches have long been concerned with how concentration or attention levels among athletes can be improved and maintained, and how distractions can be avoided. Common distractions appear to be anxiety, skill errors and mistakes, fatigue, weather, public announcements, opposition players, ‘sledging’ and negative thoughts.

Research on concentration and attention suggests that coaches can assist athletes to improve their level of attention by:
- assessing the attentional strengths and weaknesses of their athletes. Coaches should encourage athletes to think about when and where they displayed good concentration and under what conditions or situations their concentration tends to wander.
- assessing the attentional demands of a given sport. Each sport is different in terms of its attentional demands. The demand for attention varies from sport to sport and even from skill to skill (e.g. sustained attention is required for distance running and tennis, short bursts of attention are required for cricket and athletic field events, intense attention is required for sprinting events and skiing).
Strategies for improving concentration and attention

A variety of techniques have been formulated to help improve concentration and attention. These techniques should be implemented after considering the athlete’s attentional strengths and weaknesses in addition to the sport-specific attentional demands. These techniques or strategies include:

- centred or controlled breathing
- mental imagery and rehearsal (visualisation)
- positive self-talk and cue words (practise using words such as ‘relaxed hands’, ‘knees together’)
- utilising a clear pre-performance routine. This is seen when golfers follow a set routine before driving off the tee, in basketball players as they step up to the free-throw line, in tennis players before they serve and in footballers when they kick for goal.

TEST your understanding

1. Identify and provide examples of the ways performance anxiety can manifest itself.
2. (a) Explain the inverted-U hypothesis. Include a diagram. 
   (b) List three strategies that an athlete may use to increase their arousal level.
   (c) List three strategies that an athlete may use to reduce their arousal level.
3. Outline the process of mental imagery/visualisation.
4. List common distractions that can affect an athlete’s ability to concentrate.
5. Suggest ways coaches can assist athletes to improve their level of concentration.

APPLY your understanding

6. Describe, in detail, two of the techniques that can be used to control performance anxiety and arousal.
7. Identify the techniques that involve the use of mental imagery and provide detailed examples for each technique.
8. Pre-performance routines have been identified as a strategy to assist an athlete’s concentration. Choose three sports and describe a pre-performance routine that may be used in each of those sports.
9. Practical activity: Sport Competition Anxiety Test (SCAT)
   Complete the Sport Competition Anxiety Test (SCAT), then answer the following.
   (a) What was your level of anxiety?
   (b) Suggest reasons why you scored as you did.

10. Practical activity: arousal levels
    Participate in a team sport such as basketball or netball. Prior to the beginning of the game, use one of the following techniques to increase or decrease your arousal levels:
        - progressive muscle relaxation
        - meditation
        - warm-up exercises
        - pre-competition ‘psyche up’.
    At halftime, undertake a different technique before resuming the game.
    (a) What techniques did you practise?
    (b) What effect did each of the techniques have on your performance?
    (c) Were these techniques appropriate for the sport you participated in? Explain.

EXAM practice

11. (ACHPER Trial Exam 2016, question 2)
    In 2011 there were nearly 600 000 members of golf courses in Australia. Many of these courses hold a weekly competition for their members to play in. The competition normally costs a small amount of money ($5) to enter and the winners receive prizes from the golf club such as trophies and golf equipment. The games are played under professional competition rules and all the golfers’ scores are logged and recorded for data use in the future.
    (a) Discuss, and include two signs of, how ‘stress’ and ‘tension’ can negatively affect the performance of an amateur golfer.  
       3 marks
    (b) Professional golfers would undergo practices to help alleviate psychological detractors to performance. Explain one of these and how they help improve performance.  
       2 marks
KEY SKILLS PERFORMANCE ENHANCEMENT AND RECOVERY STRATEGIES: PSYCHOLOGICAL, NUTRITIONAL AND HYDRATION

KEY SKILLS
- Evaluate a range of psychological strategies that affect performance and recovery
- Explain and apply relevant nutritional and rehydration strategies to enhance recovery

UNDERSTANDING THE KEY SKILLS
To address these key skills, it is important to remember the following:
- Be able to provide a detailed account and determine the importance of a range of psychological strategies that will impact on the performance and recovery of a variety of different athletes and situations.
- Be able to provide a detailed account and determine the importance of a range of nutritional and rehydration strategies that impact on recovery specific to different types of athletes and circumstances.

PRACTICE QUESTION
1. (adapted from ACHPER Trial Exam 2015, question 3)
   Maria Sharapova has not defeated Serena Williams in a grand slam tennis tournament in 10 years. In 2015, Serena again defeated Maria in the final of the Australian Open.
   a. **Provide one psychological strategy** that Maria could incorporate into her preparation prior to the next grand slam match in order to improve her performance. **Describe the strategy selected.** 3 marks
   b. **Explain how the strategy selected** in part a could **improve Maria's performance** in a grand slam final against Serena Williams. 2 marks

SAMPLE RESPONSE
a. May select and describe any one of (but not limited to) the following psychological strategies:
   - **Stress inoculation training (SIT)** is where an athlete exposes the body to certain situations, so that they develop immunity to high pressure situations.
   - **Biofeedback** is when an athlete uses electrical sensors to help them receive information about their body functions. It helps them to focus on relaxing certain muscles.
   - **Breathing control** is when an athlete slows down their breathing and breathes deeply in order to decrease muscle tension.
   - **Progressive muscle relaxation (PMR)** is where athletes undergo a series of progressive muscle tightening and relaxing exercises in order to release tension in the body.

b. Explanation of how the strategy chosen could improve Maria’s performance:
   - **Stress inoculation training (SIT)** — Maria might have a scoreboard that she uses during training that has a score line where she is behind and has to work through coping strategies to overcome that information and employ positive self-talk and imagery to help her maintain a high level of performance that is free of errors. This would increase her ability to cope with such close and tense situations in the match in order to allow her to perform at her optimum.
   - **Biofeedback** — In monitoring the electrical activity that causes her muscle contractions, Maria will develop the power to use her thoughts to control her body, make subtle changes such as relaxing certain muscles and therefore improve her overall performance.
   - **Breathing control** — Maria’s coach may help her develop this technique of encouraging slow and deep breathing, so that she is able to maintain control over her anxiety and ignore irrelevant cues. She may use breathing control when she is in between games or as she is walking back to the service line, allowing her to focus specifically on her next action and increasing the likelihood of a successful performance.
   - **Progressive muscle relaxation (PMR)** — through repetitive practice of tensing and releasing one muscle group at a time, Maria will learn to recognise the different feelings associated with tense and relaxed muscles. With this knowledge, she will be able to induce muscle relaxation strategies at the early signs of tension. If Maria is over-aroused prior to the game, she may undertake PMR in order to instigate a state of muscular and mental relaxation to allow her to be at her optimum level of performance.

HOW THE MARKS ARE AWARDED
- 3 marks: 1 mark for the identification of an appropriate psychological strategy and 2 marks for describing the strategy and its effect on performance.
- 2 marks: 1 mark for discussing examples of how the psychological strategy could be incorporated and 1 mark for explaining how it could lead to the improved performance of the tennis match.

CHAPTER 13 • Performance enhancement and recovery strategies: psychological, nutritional and hydration
CHAPTER REVIEW PERFORMANCE ENHANCEMENT AND RECOVERY STRATEGIES: PSYCHOLOGICAL, NUTRITIONAL AND HYDRATION

CHAPTER SUMMARY

Nutritional needs

- It is essential that all athletes consume the correct balance of nutrients to supply their body with the energy needed for physical activity and to aid in the recovery process.
- The main nutrients required to supply the body with energy include carbohydrate, protein and fat. Carbohydrate-rich food should constitute approximately 55–65 per cent of our total daily intake, protein should contribute 15 per cent and fats 20–30 per cent; however, the percentages will vary according to each individual athlete’s specific needs.
- Not only must athletes adhere to these dietary guidelines, they must also develop their own eating plan to help achieve the best from their training. This plan will be specific to their sporting event, ensure an optimal intake of nutrients and meet the need for increased fluid and energy.
- Carbohydrate is broken down into glucose and transported in the bloodstream as a source of energy to fuel working muscles. Glucose is stored as glycogen in the liver and muscles if the body does not require energy immediately.
- Carbohydrate provides the body with its major fuel source for exercise during both extended high-intensity work and prolonged submaximal work. As the ability to store carbohydrate is limited, it is important to consume the appropriate amount before, during and after exercise. Training will dictate the amount of carbohydrate needed by the individual athlete.
- The glycaemic index (GI) is a ranking system that compares individual carbohydrate foods according to how they affect blood-glucose levels.
  - Foods with a high glycaemic index are appropriate for the rapid recovery of muscle glycogen stores.
  - Foods with a low glycaemic index are appropriate for sustained energy during an event.
- Protein is required to assist in the recovery or repair of damaged body tissue. It is also needed for the growth of additional muscle tissue when using resistance training to achieve gains in body strength. Additional amounts of protein are usually achieved by the increase in carbohydrate intake as a part of the training diet. Protein supplements are rarely needed in addition to this. Timing of protein consumption is a more important consideration for the athlete.
- The consumption of both carbohydrate and protein 1 (CHO): 4 (protein) post-exercise will enhance the nutritional recovery process due to the increased presence of insulin, which stimulates muscle growth and also the uptake of glycogen into the muscle cells.
- Athletes must plan pre-event, event and recovery diet programs to ensure they have appropriate nutrition to optimise performance. During post-event recovery, athletes must restore muscle and liver glycogen stores as quickly as possible when the rate of glycogen synthesis is at its greatest.
- It is important that an athlete considers effective immune system functioning as a part of their recovery nutrition. They may do this by consuming micronutrients such as vitamin C and E, glutamine, zinc and probiotics. Carbohydrates also reduce the stress hormone response and supply fuel to the immune system white cells.
- Carbohydration is a convenient and effective way of consuming carbohydrates to replace used stores, while also addressing the need to keep the body hydrated. Commercially prepared sports drinks are the most common form of carbohydrate used by athletes today.

Hydration

- Fluid loss can lead to a decline in performance. It is important to consume fluid before, during (if applicable) and after exercise. Water is suitable for short-duration events lasting less than 60 minutes; longer events are better served by a sports drink that contains carbohydrate and electrolytes.
- Most athletes should consume approximately 200–600 millilitres of fluid prior to their event, and replace approximately 500–1000 millilitres of fluid per hour during the actual event. Athletes should begin drinking early in exercise and consume small volumes (200–300 millilitres) every 15–20 minutes if possible.
- Sports drinks can be classified as isotonic (4–8 per cent carbohydrate), hypotonic (low level of carbohydrate; less than 4 per cent) or hypertonic (high level of carbohydrate; greater than 8 per cent).
- Intravenous (IV) infusions for rehydration are only permitted under the World Anti-Doping Agency (WADA) code for medical reasons, not for convenience or faster rehydration of an athlete.
Psychological strategies

- Sports psychologists focus on techniques that athletes can use in competitive and training situations so as to optimise their performance.
- Performance anxiety and arousal are both emotional control factors that can impact on performance. Techniques to manage these include reduction techniques such as progressive muscle relaxation, controlled breathing and meditation, as well as promotion techniques including acting energetically, elevating breathing rate and energising imagery.
- Concentration involves focusing on the task at hand and can be improved via mental imagery and rehearsal, positive self-talk, cue words and using pre-performance routines.
- Sleep is very important as lack of sleep can have both physiological and psychological effects on the body. Establishing a pre-sleep routine and paying attention to nutrition can assist with better sleep.
- SMARTER is the acronym used to assist athletes to set goals to work towards achieving specific objectives. SMARTER stands for Specific, Measurable, Accepted, Realistic, Timeframed, Exciting and Recorded.
- Biofeedback is a tool that provides information to the athlete about their physiological responses, which enables them to acquire some skills that enhance the relationship between their physical and mental performance.
- Stress inoculation training allows the athlete to learn to prepare for any stressors, control their responses to the stressors and maintain their focus in competition.
- Simulation and mental imagery used together enhance the athlete’s psychological readiness for competition.

EXAM PREPARATION

MULTIPLE CHOICE QUESTIONS

1. Positive self-talk is a psychological skills strategy that could be used when a performer is experiencing
   (A) over-arousal.
   (B) ideal arousal.
   (C) under-arousal.
   (D) neutral arousal.

2. A Collingwood Magpies netball player is sitting on the bench at quarter-time in the National Netball League competition. Her sports psychologist requires her to undertake an arousal reduction technique during the break. Which of the following is not an example of a suitable arousal reduction technique for the netball player?
   (A) Listening to motivational music
   (B) Biofeedback
   (C) Positive self-talk
   (D) Breathing control

3. Jeffrey Symonds of Canada won the Asia-Pacific Ironman Triathlon held in Melbourne in March 2015.
   His winning time for the event was 8 hours, 4 minutes and 29 seconds. Two to four hours following the event, Symonds would best enhance his recovery by eating
   (A) high glycaemic index foods as this would better assist in the replenishment of depleted glycogen stores.
   (B) low glycaemic index foods as this would better assist in the replenishment of depleted glycogen stores.
   (C) a mixture of high and low glycaemic index foods, as well as foods high in fats to replace lost glycogen and triglyceride stores.
   (D) a mixture of high and low glycaemic index foods as well as foods high in protein.

4. Combining carbohydrates and protein enhances recovery by
   (A) reducing insulin secretion and maximising the absorption of carbohydrates.
   (B) allowing muscle repair and catabolic adaptation to training to occur, and also for the restoration of muscle glycogen levels.
   (C) stimulating insulin release, which acts as a catabolic hormone to increase the uptake of amino acids and enhance muscle recovery and growth.
   (D) allowing muscle repair and anabolic adaptation to training to occur, and also for the restoration of muscle glycogen levels.
5 (ACHPER Trial Exam 2013, question 7)
An archer competing at the Olympics in the gold-medal round would require which of the following arousal levels for the best chance of success?

(a) Performance Low Arousal Low
    Performance High Arousal High

(b) Performance Low Arousal High
    Performance High Arousal Low

(c) Performance Low Arousal High
    Performance High Arousal Low

(d) Performance Low Arousal High
    Performance High Arousal High

6 (ACHPER Trial Exam 2013, question 8)
Sleep is an essential part of the recovery process. Lack of sleep (sleep debt) is known to cause
(A) increased levels of stress hormones, such as cortisol.
(B) decreased perceived exertion.
(C) increased activity of human growth hormone.
(D) increased ability to metabolise glucose.

7 (ACHPER Trial Exam 2011, question 14)
In goal setting, the ‘A’ in the acronym ‘SMARTER’ refers to
(A) Accepted.
(B) Achievable.
(C) Activity.
(D) Advantage.

8 (ACHPER Trial Exam 2012, question 9)
An elite netballer has a history of ‘choking’ when involved in intense game situations, which leads to a decrease in her performance, thus affecting the overall team performance. Which of the following would be the most effective to reduce the problem of ‘choking’ in a game?
(A) Stress inoculation training
(B) Undergoing meditation at half-time
(C) Consuming high GI foods and drinks prior to the game
(D) Employing biofeedback throughout the game
The above graph represents the performance arousal curve for three different sports. Arousal curves 1, 2 and 3 are best represented by:

(A) (1) Boxing, (2) Basketball (3) Archery
(B) (1) Basketball, (2) Archery (3) Boxing
(C) (1) Archery, (2) Basketball (3) Boxing
(D) (1) Netball, (2) Basketball (3) Soccer

Goals can be categorised into three classifications. The type of goal that is generally out of an athlete's control is a:

(A) performance goal.
(B) outcome goal.
(C) conditional goal.
(D) process goal.
Question 1  
**ACHPER Trial Exam 2016, question 4**

The graph below shows the heart rate of an athlete who completed an 8-km fun run in 32 minutes.

Following the 8-km event, the runner consumed a sports drink and a protein bar. Discuss how these products may lead to enhanced recovery following the event.  

3 marks

Question 2  
**ACHPER Trial Exam 2016, question 10**

The 2016 Australian Open Tennis Championships were held in Melbourne from January 18 to January 31. During some of the matches, the players were required to compete in temperatures above 35 degrees Celsius. Sometimes players’ performances are negatively affected because of the heat.

In the past, some players have used intravenous (IV) fluid ingestion following matches played in extreme heat. Evaluate the effectiveness of this procedure and compare it to oral hydration practices.  

4 marks

Question 3  
**ACHPER Trial Exam 2016, question 13**

Nick Kyrgios usually enters a tennis match listening to music. Utilising a diagram, explain the benefit of listening to music from a psychological perspective.  

3 marks

Question 4  
**ACHPER Trial Exam 2009, question 7**

There are a number of different sports drinks on the market but they fall mainly into two categories: isotonic and hypertonic.

a. Outline the difference between an isotonic sports drink and a hypertonic sports drink.  

2 marks

b. Under what circumstances would it be preferable for an athlete to ingest a hypertonic sports drink in preference to an isotonic one?  

1 mark

c. Identify three guidelines an athlete should follow to ensure they remain adequately hydrated before, during and after exercise.  

3 marks
Question 5  
(ACHPER Trial Exam 2008, question 14)

The Under-21 Australian women’s hockey team has just completed a tournament in The Netherlands playing a series of games over a 10-day period. The Australian coach instructed her athletes to consume a snack consisting of bananas, muffins and Gatorade drinks within 30 minutes after each game.

a. Briefly explain why it is important to consume this type of snack within 30 minutes after the game.  
2 marks

b. Many athletes drink specially designed sports drinks during the game. Briefly explain the benefit of consuming a drink with 4–8 grams of carbohydrates per 100 mL.  
2 marks