UPDATED and EXPANDED

THE **COMPLETE GUIDE** TO

FOOD FOR SPORTS PERFORMANCE

PEAK NUTRITION FOR **YOUR** SPORT

Dr LOUISE BURKE & GREG COX

FOREWORD BY NATHAN DEAKES

Part I

PRINCIPLES OF SPORTS NUTRITION

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Training nutrition: The principles of everyday eating

To many people, sports nutrition is about carbo-loading for a competition, or having the latest sports food or supplement. However, the 'big-ticket item' with the most potential to influence your sports performance is your training diet. On the basis of time alone, your training diet is the aspect of your total nutrition most likely to make an impact on your body. It also lays the groundwork that is critical to your long-term success. Everyday eating must keep you healthy and uninjured, and in top shape for your sport. And it must support you through all the training that is needed to get you to the starting line or opening bounce.

Daily training creates special nutritional needs for an athlete, particularly the elite athlete whose training commitment is almost a full-time job. But even recreational sport will create nutritional challenges. And whatever your level of involvement in sport, you must meet these challenges if you're to achieve the maximum return from training. Without sound eating, much of the purpose of your training might be lost. In the worst-case scenario, dietary problems and deficiencies may directly impair training performance. In other situations, you might improve, but at a rate that is below your potential or slower than your competitors. However, on the positive side, with the right everyday eating plan your commitment to training will be fully rewarded.

So what does a successful training diet look like? There is no perfect combination of foods or single eating plan that will meet the nutritional challenges of every athlete. When you read Part II of this book, you will find that nutritional needs and interests vary between sports. Imagine trying to find a single menu to encompass the food likes and dislikes,

not to mention the lifestyles, of all athletes! While the focus and details will differ from one athlete to the next, there are certain goals that are common to all sports. Checklist 1.1 will help you to rate the success of your training diet. If you are achieving all these goals with your everyday eating plan, then congratulate yourself for having achieved peak training nutrition.

Obviously, peak training nutrition doesn't happen by chance. Before you can branch into the special and individual areas of sports nutrition, you must start with some general principles, based on the common ground shared by all athletes. Once you have a structure in place, you can fine-tune your eating plan to respond to your particular nutritional needs and dietary goals. At each level, knowing more about what is in food and how to select and prepare it will give you more control over what you eat. You can choose to meet your dietary challenges in ways that are both enjoyable to you and complementary to your busy schedule. So let's start with the basic principles.

1.1 Enjoy a variety of food

Most countries have a set of dietary guidelines, and most begin with a recommendation to 'eat a variety of foods every day'. Some qualify this, saying, 'eat a variety of nutrient-dense foods every day'. Others have even quantified this information—the old Japanese guidelines recommended that we 'eat at least thirty different foods each day'. But what does variety really mean, and why does it come up over and over as the No. 1 nutrition recommendation?

We tend to take an overly simplistic view of the food we eat, focusing on one or two nutrients, such as iron, cholesterol or sugar. One side-effect of this habit is that we pin labels on food—for example, we might believe that yoghurt is 'good' for us while chocolate is 'bad'. In fact, it's the way we use food that determines whether it's a good or bad choice in assisting us to meet our specific nutrition goals. This depends on what we are trying to achieve and what else we eat over the course of the day. For instance, a banana mega-smoothie might be a great afternoon snack for a hungry basketball player with high energy (kilojoule) needs. But it would blow the kilojoule budget of a tiny gymnast, and wouldn't be well tolerated by a runner at the 30-km mark of a marathon. The real value

of a food needs to be judged in context. This is a key theme that we will return to many times in this book.

One of the problems with the simplistic branding of foods as 'good' and 'bad' is that it can lead to narrow and rigid eating. Some people try to follow a 'good diet' by giving up all the foods they consider 'bad'. Athletes are particularly skilled at this because they are motivated (often obsessively so) and good at self-discipline. It takes mental toughness to stare at a black line on the bottom of a pool for hours on end, or to run kilometre after kilometre in the zone—and this focus can easily be extended to breakfast, lunch and dinner. Of course, other factors such as fussy eating, real or perceived food intolerances, poor domestic skills and a tight budget can all lead to a narrow, unvarying diet.

To understand what is at stake, we need to appreciate how marvellously complex our food really is. Nutrients and food chemicals do not exist in isolation and are not consumed that way. There is more to an orange than vitamin C, and more to meat than protein. What's more, each food is greater than the sum of its components, because the chemicals in a food interact with each other and with the chemicals in other foods eaten at the same time. Although some popular diet books have spread the myth that certain foods shouldn't be eaten in combination, the truth is that the nutritional quality of a meal is often improved by mixing and matching foods. For example, the iron in cereal foods is better absorbed in the presence of vitamin C, making a glass of orange juice a clever accompaniment to your breakfast cereal.

An emerging theme in nutrition is the recognition that we have barely begun to learn about the full range of chemical and physical properties of food. To paraphrase the former US Secretary of Defense, Donald Rumsfeld, our food is full of 'known unknowns' and 'unknown unknowns' as well as all the things we do know about. We often discover that a certain group of people enjoys unusually good health or a low risk of developing the diseases of ageing—for example, cancer, diabetes, high blood pressure and cardiovascular diseases. This is often attributed to their dietary patterns—for example, the fact that they eat lots of fruits and vegetables or certain types of oils. We next jump to the conclusion that the health benefit comes from a well-known nutrient found in these singled-out foods, and that we could share this benefit by taking the nutrient in pill or powdered form. After all, it's much simpler to pop

a pill to stay healthy than to make radical changes to your eating. The problem with this logic is that joining the dots so crudely skates over the complexity of all those unknowns in the original food supply.

Newspapers and scientific journals continue to report on our identification of ranges of antioxidants and active ingredients in plant foods—often termed 'phytochemicals' or 'phytonutrients'. Table 1.1 provides a list of just some of these chemicals—within each category, there may be hundreds of individual compounds. While supplements and functional foods (foods to which some special ingredients are added) can contribute to nutritional goals, at this stage they lag well behind the genius of Mother Nature. In the future, with improved knowledge, we may be able to unravel some of her mysteries to make firm recommendations about these phytonutrients. For the moment, enjoying a wide variety of nutrient-dense foods, both in your general diet and at each meal, provides the best way to sample a little of everything food has to offer.

Seen from another angle, consuming a varied diet is 'eating in moderation'. Harmful substances can occur naturally in foods (e.g. the poison solanine, which occurs in green sprouting potatoes) as well as being overrepresented in manufactured foods (e.g. the unhealthy 'trans' fatty acids which arise when vegetable oils are processed). Since the nutritional problems in countries such as Australia and the United States are linked mostly to overconsumption of dietary compounds, eating a wide variety of foods is a good way to keep your intake of all food components within healthy bounds. The nutrition education campaigns in most countries still feature a pictorial model of a healthy diet—such as a pyramid or triangle or food plate—in which different types of foods can be arranged with the priority on 'most of what you need' topped off by 'a little of what you fancy'.

Last, but by no means least, a varied diet offers greater opportunities for flexibility, enjoyment and adventure with food. Newer dietary guidelines in many countries make a definite point of promoting the experience of eating. For example, the new Japanese guidelines urge people to 'have delicious and healthy meals that are good for your mind and body; enjoy communication at the table with your family and other people, and participate in the preparation of meals'. It might seem strange that government departments feel the need to formally promote these ideas. However, in many countries, it is a sad reality that each

succeeding generation has less exposure to family mealtimes, learning to cook, understanding food composition or appreciating the food culture of the preceding generation. Use Checklist 1.2 to ensure that you are maximising the benefits of variety.

1.2 Eat the right type and amount of fats and oils

In the old days we simply said 'eat less fats and oils', based on the observation that the typical Australian diet contains more fat than is necessary or healthy. The direct benefits of cutting back on fats include promoting healthy weight or weight loss and reducing the risk of some lifestyle diseases. Indirect benefits include making room in the energy budget for some more valuable foods and nutrients. Nutrition guidelines recommend that total average fat intake be reduced by a quarter, to less than 30 per cent of total energy. For people needing to reduce body fat, a further reduction to 20–25 per cent of intake may help to reduce total energy intake. But guidelines for a lower average fat intake were never meant to promote a 'no-fat' intake. After all, fats and oils are widely distributed in foods and have many benefits. They provide a concentrated source of energy, and they make meals tasty, satisfying and rich in texture. They also supply essential fatty acids and fat-soluble vitamins, which are important to health. We need a minimum of 20–40 g (1–2 tablespoons) of the right fats each day to get enough of these nutrients.

Newer nutrition guidelines target not just the total *amount* of fat in our diets, but also the *types* of fats and oils we eat. Depending on their chemical structure, different fats have different effects on your weight, on how well your body responds to insulin, and on blood fat and cholesterol levels. Unfortunately, most of us overeat the 'unhealthy' fats and undereat the 'healthy' ones. The fats we overconsume are the saturated types and trans fatty acids. Saturated fats come mostly from animal sources such as meat and dairy foods, but they are also found in coconut and palm oils. Because these oils are perfect for many aspects of food manufacture, they end up in deep-fried foods, pastry items, confectionery, biscuits and snack foods. Many of us fail to recognise the high fat content of such foods, or we mistake it as being healthy because the oil is labelled as a vegetable one. Trans fats occur naturally in small amounts in meat and dairy foods, but they are also artificially created

when polyunsaturated and monounsaturated fats undergo processing (hydrogenation) during food manufacture. As a result, these fats are overrepresented in diets high in processed foods. Both saturated and trans fats increase the unhealthy type of blood cholesterol known as LDL (low density lipoprotein) cholesterol while trans fats also decrease the healthy cholesterol known as HDL. Our efforts to reduce our intake of fats and oils should focus on the unsaturated types.

The preferred fats are polyunsaturated and monounsaturated. Monounsaturated fats are found in many vegetable oils and animal fats, but the richest sources are olives/olive oil, peanuts/peanut oil, other nuts, canola oils and avocadoes. These fats have a small lowering effect on LDL cholesterol levels and do not appear to be as 'fattening' as their advertised kilojoule content. Polyunsaturated fats come in various forms and have favourable effects on blood fat levels. One family, known as the omega-3s, is found in a small number of vegetable oils, such as canola and linseed, and in larger amounts in oily fish. Some functional foods with added omega-3s are also appearing on our supermarket shelves. Omega-3 fats appear to offer a range of health benefits—lowering blood fat levels and blood pressure, reducing the build-up of fatty deposits in blood vessels and blood clots, and preventing irregular heart rhythms. They may also have beneficial effects on immune and inflammatory diseases such as asthma, eczema, psoriasis, rheumatoid arthritis and inflammatory bowel disease. There is also encouraging news linking omega-3s to improved insulin sensitivity and lowered risk of diabetes, along with better brain functioning and maintenance.

Another group of polyunsaturated fats is the omega-6 series, found in the majority of vegetable oils (safflower, sunflower), as well as wholegrain cereals and nuts. Although they have a positive effect on blood fat levels, they are structural competitors to the omega-3 series and may counteract their effects—for example, by increasing inflammation. Unfortunately, we now consume a diet heavily skewed to omega-6 fatty acids rather than the omega-3 family, so nutritional guidelines promote a better balance by increasing intake of the first and reducing intake of the second. Checklist 1.3 provides strategies to achieve all the guidelines related to fats and oils.

While athletes need to think about eating for their future health (life does go on after the Olympic Games!), they are understandably

more interested in the here and now, specifically, the role of dietary fat in sports performance. The traditional view on this front is that although dietary fats and oils are the most concentrated source of food energy, they do not provide the major source of fuel for exercising muscles. Instead, body carbohydrate stores provide the critical energy source for strenuous activity. These, however, are limited in size. Body fat stores, on the other hand, are in plentiful supply even in the leanest of athletes, and could provide fatty acids for hours and days of exercise. From time to time, interest is rekindled in making endurance and ultra-endurance athletes more effective at burning body fat as a muscle fuel by adapting them to high-fat diets. This strategy will be discussed in more detail in the next chapter, but at this stage it doesn't appear to have much to offer the majority of athletes. In fact, a high fat intake could be of disservice to an athlete if it displaces carbohydrates whose kilojoules were needed to meet muscle fuel needs.

Fat intake can have an indirect effect on sports performance. Fats and oils have twice the energy density of protein and carbohydrate—that is, more than twice the kilojoules per mouthful. This means that it is easy to overshoot your daily energy requirements with a diet based on fatty foods, especially in a food culture that encourages large servings and frequent eating. What's more, there is some evidence that diets high in saturated and trans fats are especially efficient at increasing body-fat stores. On the other hand, a switch to lower-fat eating can help to reduce body-fat levels or protect you from gaining body fat, since you have to eat more mouthfuls to meet your energy needs. Of course, as we will see in the next section, this principle doesn't work if you simply replace fat with other energy-dense foods or unnecessarily large portions of low-fat foods.

1.3 Eat the right amount of nutrient-dense carbohydrate foods

If the messages regarding fats and oils needed fine-tuning, then it's fair to say that the carbohydrate message has required an overhaul. When the original guidelines that promoted a higher carbohydrate intake were released, nutrition experts had in mind that people would eat more wholesome, fibre- and nutrient-rich foods such as wholegrain breads

and cereals, fruits and vegetables to replace their reduced intake of foods high in saturated fats. We expected benefits in terms of better fuel intake for active people, lower food-energy density to assist with weight control, and overall improvements in nutrient density (more vitamins and minerals per mouthful). We didn't anticipate that the food industry would respond with a huge array of low-fat carbohydrate-rich foods, or that consumers would respond by eating them in such huge amounts. Some of these foods (e.g. low-fat versions of yoghurt and flavoured milk) might offer good nutrient value, but they weren't always lower in kilojoule content, since extra sugar kilojoules often replaced most of the lost fat ones. In other cases, a low-fat label gave people an excuse to eat carbohydrate-rich foods with limited nutritional value in extra-large portions. Think buckets of 97 per cent fat-free ice-cream, jumbo low-fat muffins, family-size packets of 'natural' no-fat confectionery. No wonder the proposed health benefits of high-carbohydrate eating didn't eventuate. No wonder we got fatter. No wonder the next phase was a return in popularity of low-carbohydrate and moderate-carbohydrate diets.

But even if the high-carb eating of the 1990s didn't benefit everyone, surely athletes were better off? After all, the critical source of fuel for exercising muscles comes from your body's carbohydrate stores—blood glucose (a small amount), and glycogen stored in the liver and muscles (larger stores, but sufficient only for up to 90 minutes of moderate to high-intensity exercise). Against this background, you would think that athletes would benefit from carbohydrate loading 24/7. Think again. The problem with this idea is that it treats all athletes as having the same high fuel requirements and a large energy budget. This isn't the case. In the second section of this book we will find plenty of examples of athletes with low to moderate fuel needs and a focus on weight control.

Our latest guidelines still recommend that Australians should allow nutrient-rich carbohydrate foods to make up around half of their total energy intake. However, there is now greater recognition that carbohydrates shouldn't be considered a bottomless well, and that the quality of carbohydrate-rich food choices is important. Even in sports nutrition, many dietitians avoid using the term 'high-carbohydrate diet' because of the way it has been misinterpreted by athletes and coaches. 'Targeted' carbohydrate eating is probably a better term since it implies

matching intake to daily fuel needs. In fact, some Australians, including some athletes, do need to cut back on their intake of certain carbohydrate-rich foods.

Does this mean that lower-carb eating plans are here to stay? Those of us who've been in nutrition for a long time know that ideas are constantly recycled and the present fashions will probably disappear, only to be reinvented further down the track. There are good lessons in some of the diets based on moderate-carbohydrate eating (e.g. the CSIRO diet), although many athletes will need to adjust such plans to increase their intake of fuel foods. On the other hand, the Atkins diet and other strict low-carb diets will not cure the world's nutrition problems or provide a long-term solution to obesity and overweight. In fact, they suffer from some of the same problems that 'sunk' the high-carb movement—people take them to extremes, use them to justify eating food with low nutrient content, and fail to understand what sensible portion sizes really are. More information on this will be provided in a case history in the second part of this book.

Whatever our carbohydrate target is, we need to think carefully about the types of foods and drinks we use to reach it. We used to think about carbohydrates based on structure—'simple' carbohydrates (or sugars) of one or two molecules, or 'complex' carbohydrates (or starches) made up of thousands of sugar molecules joined together. The sugars were allegedly the bad guys, causing tooth decay, shooting blood-sugar levels up and down, and failing to provide vitamins and minerals. The complex carbohydrates were the good guys, reversing all these problems. Thankfully, we have moved on from this to a less black-and-white view. There are many features of carbohydrate-rich foods that could be considered, but for the purposes of sports nutrition we will focus on three: total nutritional value, effect on blood glucose and practical issues. Many 'ready reckoners' of carbohydrate-rich foods, like the one in Chapter 2, show the total amount of carbohydrate provided by various foods and drinks, but in any given situation certain foods may confer an advantage because of one or all three of these features. Different situations have different demands—it's all about 'horses for courses' rather than 'good' and 'bad' carbohydrate-rich foods.

Total nutritional value

Most of the time, athletes should aim to get maximum nutritional value from the kilojoules they eat. While a system describing the nutritional value of foods will always be arbitrary, we can try to simplify carbohydrate-rich foods into categories of 'wholesome/nutrient-dense' and 'refined'. 'Wholesome' or 'nutrient-dense' carbohydrate-rich foods can also be described as those providing valuable amounts of vitamins, minerals, protein or fibre for a moderate kilojoule intake. By contrast, 'refined' carbohydrate-rich sources are foods or drinks that have been processed to remove much of their original nutritional value, or foods in which fat and sugar add lots of kilojoules to dilute the total nutrient–energy ratio. Table 1.2 provides examples of carbohydrate-rich foods that might fall into the 'wholesome' and 'refined' categories, and shows how poorly 'simple' and 'complex' labels track nutritional value. For example, just as some simple carbohydrate-rich foods provide valuable fibre and vitamins (for example, fruit), other 'complex carbohydrate'-rich foods are a negligible source of fibre, vitamins or minerals (for example, a Danish pastry). There are also carbohydrate-rich foods that contain significant amounts of both 'complex' and 'simple' carbohydrates (for example, a breakfast cereal combining grains and dried fruit). And of course, the total nutritional value of a meal or snack is based on the company that the carbohydrate-rich food keeps. Pasta coated with a buttery sauce is a different choice from pasta tossed with lean meat and vegetables; white bread and jam should be judged differently from a multigrain sandwich with chicken and salad.

Fibre is one component of most wholesome carbohydrate-rich foods. Actually, fibre is a family of compounds whose members include soluble fibre, insoluble fibre and the more newly recognised 'resistant starch'. Different types of fibre have different effects on the digestion and metabolism of food. These include aiding digestion, regulating blood glucose and blood cholesterol levels, and perhaps reducing the risk of some cancers. Fibre is also useful in making food and meals filling—an invaluable aid when you're cutting back on kilojoules to lose body fat.

Fibre is found in fruit and vegetable foods—or, more precisely, fibre occurs naturally in these foods. Quite often the processing of food removes much of the fibre—not just in the food factory, but in the restaurant or in

your kitchen. It's not uncommon for people to eat processed food minus its fibre, then buy a fibre supplement in the belief that this is 'healthy'. The best guideline is to eat fibre as it naturally occurs in the variety of foods that you eat. This will ensure that you get a mixture of the fibre types, and that the quantity of fibre varies with your energy and nutrient intake.

Like anything else, too much fibre has its disadvantages. Adding bulkiness and volume to foods is useful for those with low energy requirements, but it can make life difficult for athletes with higher energy needs. For them, high-fibre foods may exceed their stomach's comfort limit. Too much fibre intake, or a sudden increase in fibre intake, can also lead to flatulence and diarrhoea. Fibre-rich foods may not be the best choice just before training or competition. So be guided by a sensible amount and variety of fibre intake. Most times you will be pleased to enjoy the fibre that naturally occurs in your carbohydrate-rich foods. However, know the limits and the times for limiting!

Although replacing wholesome carbohydrates with sugary foods might be seen as forgoing some health benefits, it is worth considering the common charge that sugar is directly harmful to health. Most of the time when we use the term sugar, we mean sucrose, the most commonly occurring simple carbohydrate in the Western diet. Of all carbohydrate-rich foods, it is the most refined, being extracted from sugar cane and purified to remove all other compounds—including nutrients. In some parts of the world, high-fructose syrups refined from corn are replacing sucrose as a cheaper form of sweet kilojoules. Whatever the form—sucrose, high-fructose corn syrups, honey or glucose—it's all 'empty' kilojoules.

Several health problems have been linked to *excessive* intake of these refined sugars and their association with other unhealthy eating habits. The current intake of sugar in Australia is almost a kilogram a week, or about 20 per cent of total energy intake. This is way more than most people need, which explains why one of the dietary guidelines for Australians is 'consume only moderate amounts of sugars and foods containing added sugars'. Sugar is a compact and delicious high-kilojoule food that is easily overeaten. And it often keeps bad company—think of sugar-coated saturated fats such as chocolate, cakes and ice-cream. A combination of high kilojoules and fat, and in many cases the relative

absence of fibre, vitamins and minerals, is where the potential for overuse and detriment to health lies. Sugar intake is also strongly linked to tooth decay. Of course, it is a bit more complicated than this. Tooth decay occurs when the bacteria in plaque turn carbohydrates into an acid that erodes tooth enamel. So any sticky carbohydrate that is left on the teeth will cause problems. Dental health is not only a matter of making good food choices, but also of ensuring that teeth have minimal contact with foods by brushing after eating and recognising the risks associated with constant grazing.

Effect on blood glucose

We've already mentioned the old theory that simple sugars cause rapid surges and plunges in blood sugar levels, and that complex carbohydrate foods maintain more even levels. However, research has shown that this is a myth; in fact, each carbohydrate-rich food has a unique effect on blood glucose concentrations and metabolic processes, and this effect is quite unconnected to its structure. Blood glucose changes are related to the speed with which the food is digested and absorbed. Many factors influence this—including the type and amount of fibre in a food, the way in which complex carbohydrate molecules are joined, and even the physical form of the food (whether it is thick and sticky, in whole pieces or mashed up, and even hot versus cold). You can't predict how a food will affect blood glucose levels—you can only measure the results.

The Glycemic Index (GI) is a ranking system created to compare carbohydrate-rich foods according to the blood glucose responses produced in a standard test. Test subjects eat the food first thing in the morning in a serve that provides 50 g of carbohydrate. The resulting blood-glucose curve is compared to the response achieved when 50 g of carbohydrate is consumed from standard food known to produce a high glucose response (by convention, either pure glucose powder or white bread). The foods are then classed as 'high GI'—those that produce more than 70 per cent of the blood-glucose response to the standard—and 'low GI'—those that produce less than 55 per cent of the standard response. Table 1.3 provides a list of the published GI values for some common carbohydrate-rich foods. In Australia, the GI Symbol Program allows food manufacturers to have their products officially tested and carry

information about their measured GI on labels and promotional material (*www.gisymbol.com.au*). Although there are differences between specific products, some foods play against the stereotypes of carbohydrate foods. For example, bread and potatoes typically have a higher GI than sugar. It's just more evidence of the need to throw out our previous ideas about the value of simple or complex carbohydrates.

In some areas of nutrition, particularly in the prevention and treatment of diabetes and high blood-fat levels, the Glycemic Index has been used to design eating patterns that manipulate blood-glucose levels into the favourable zone. Lower-GI meals or diets have sometimes also been associated with better 'satiety' (the feeling of fullness or satisfaction that we feel after eating). Several popular diet books promote reduced-GI eating as a way to prevent or treat overweight, since kilojoule intake will be reduced if people feel less inclined to overeat or snack unnecessarily. Some people propose that certain areas of sports nutrition might be improved by the ability to control or produce a predictable blood-glucose response. It is often suggested that high-GI carbohydrate-rich foods are most appropriate for replenishing muscle glycogen stores after strenuous exercise, while low-GI carbohydrate-rich meals are best for a pre-competition meal. Although these ideas aren't universally true, some athletes in some situations may benefit from choosing foods in a certain GI class. Remember, though, this is just one more piece of the food puzzle, not a universal tick of approval for a particular type of food.

Practical issues

It doesn't matter how good a food looks on paper. Food doesn't become 'nutrition' until a person has actually eaten it. Unfortunately, athletes often find it a challenge to eat the amount of carbohydrate they need at crucial times. For a start, an athlete may simply not like a food. What if Brussels sprouts were found to contain a magic ingredient for sports performance? Other challenges include appetite, availability of food, and stomach 'fullness'. These challenges most often appear at the crucial times before, during and after exercise.

The key to sports nutrition is finding practical ways to consume the carbohydrate you need to meet the fuel needs for your particular situation. At times you may need to find a carbohydrate-rich food that's

easy to eat when you're on the move, for example, or when gut issues are important—one that's not too fibrous or filling. On other occasions, you may need a portable and non-perishable food that can travel with you to training or a competition venue. In these situations, logistics may take priority over perfect nutritional qualities—and a sports dietitian may actually prescribe a sugary food over a high-fibre food that's full of vitamins! This is all part of dietary balance.

Checklist 1.4 provides some hints for getting the general balance of carbohydrates right—neither overemphasising them nor shunning them in fear—and for putting your focus on the wholesome choices. In the next chapter, we will find strategies for fine-tuning the carbohydrate intakes of athletes to meet their fuel needs during both exercise and recovery. Finally, the case histories in Part II provide examples of how athletes can choose carbohydrate-rich foods to suit the practical challenges of their sport. They also illustrate how special sports foods such as sports drinks, gels, bars and liquid meal supplements are tailor-made to help you reach nutritional goals for sport more easily.

1.4 Replace your daily fluid losses

Water is our most important nutrient. Dehydration is quickly felt and not only affects performance but at times can put life itself at risk. The nutrition guidelines in most countries encourage us to 'drink plenty of water'. There are two angles to this advice, and two sides to the water story. The first issue is the size of the fluid losses that we need to replace each day—losses that occur through urine production, bowel movements, sweat and even our breath. On average, these losses total around 2.5 litres per day, which might be the source of the generic advice that we should drink 'at least eight glasses of water each day'. But these losses can increase under different scenarios:

- if the weather or our personal environment (e.g. heating in the house) is hotter
- if the air we breathe is drier (e.g. due to air-conditioning or being at altitude, including in a pressurised plane cabin)
- if we exercise at high intensities or for prolonged periods
- during episodes of diarrhoea or vomiting.

Most of us manage to replace most of our daily fluid losses most of the time. Our fluid intakes are driven by a complex interaction of thirst (which tells us when we need to drink) and social customs or habits (for example, drinking with meals, or our rituals of 'breaks' during the workday or school day). Many people don't realise, however, that half of our fluid intake typically comes from food. Some foods have a high fluid content—for example, milk, fruits and vegetables, as well as jelly, yoghurt, ice-cream, soups and sauces. But even quite 'solid' foods like bread contribute fluid.

When our fluid losses stay constant, we probably 'luck' into a pattern that looks after our fluid needs. Some groups, such as children and the elderly, and some individuals aren't as good at getting this right—perhaps they don't read their thirst signals as well, perhaps it is more difficult for them to get access to fluids and high-fluid foods, or perhaps they aren't as good at drinking the volumes they need. Other high-risk scenarios involve a sudden change in fluid losses, fluid availability or drinking customs—for example, the onset of hot weather, an abrupt increase in sweat losses during exercise, or travel and new patterns of eating and drinking. Even if these changes lead to increased thirst or an increased awareness of the need to drink, there is often a lag of several days before we boost our fluid intake sufficiently to meet our new needs.

Reduced urine output can be a signal of inadequate fluid intake; it may show up in the form of less frequent visits to the toilet, or a change from clear, plentiful urine to small amounts of dark and concentrated urine. The first sample of the morning is the best indicator of urine volume and characteristics. Some athletes use special machines or 'urine sticks' to obtain information about the concentration of their urine. When this exceeds certain cut-off values, they know that their drinking patterns are not keeping up with their daily fluid needs and must be adjusted. Part of the Big Picture is to look after acute fluid needs during and after exercise. These will be covered in more detail in Chapter 2 (Fine tuning) and Chapter 4 (Competition nutrition). But it is also important for athletes to get their everyday hydration patterns right so they can avoid starting a training session or competition event already dehydrated. Obviously, this would compound the challenge of managing during- and after-exercise fluid intake, and create a vicious cycle of poor hydration.

The second issue that we need to consider is what we are using to replace our fluid losses. Does the advice to drink 'at least eight glasses of water' mean that we should drink only water or that we should consume this volume on top of all the other fluids and fluid-containing foods in our diet? If you Google this advice, you will find that some sources do advise people to drink at least this amount of actual water each day. Others even say that tea, coffee and caffeine-containing soft drinks not only can't be counted in our daily fluid intake, but will add to our water requirement because of the dehydration they cause. But if you read further you will find that neither the source nor the scientific evidence behind 'eight glasses' is provided. In fact, many nutrition experts consider this 'rule' to be an urban myth. As outlined above, each individual should drink enough fluids to replace their specific fluid losses each day, and adjust this intake as the losses and fluid needs change. This fluid intake comprises all drinks and the fluids found in foods. Caffeine does have a small, though usually insignificant, diuretic effect (increasing urine loss). But the overall effect of drinking tea, coffee and cola drinks on our hydration is positive—they add to our total fluid intake.

Deciding what we should drink needs to be done with our overall nutrition goals in mind. Some fluids may contribute towards other nutrition goals—for example, milk will help us to meet protein and calcium goals, and juice may be a quick and easy way for an athlete with high energy needs to 'eat' a fruit/vegetable serve. Many athletes forget that drinks are a quickly consumed source of kilojoules and nutrients—and that this can be both a boon and a danger. 'Drinking' food is useful when we don't want to have to chew our way through large amounts of fuel—if we're a growing basketball player who needs an afternoon snack that won't blunt our appetite for the evening meal, say, or a runner who needs a source of carbohydrate to consume at an aid station during a marathon. But it's a disadvantage if we have reduced energy needs; in that case we'd be better off savouring the slower and more filling experience of eating.

Anyone who is over thirty should be able to remember the time when a tap was the source of most of their daily drinks. Today, for many people tap water has been replaced by soft drinks, grande lattes, frappes, juices and even bottled water! What's more, cups and bottles have upsized considerably, so that in some places it is possible to buy a bucket of drink

as a single serve, or to receive 'bottomless' cups and endless refills. Expense and wastage of resources are some of the downsides of this cultural shift. The nutritional consequences include our increasing inability to judge appropriate portion sizes or respond appropriately to thirst. In addition, the intake of unnecessary amounts of sugar in sweetened beverages such as soft drinks, flavoured mineral water and even sports drinks is blamed for contributing to obesity rates. Even juices, with their antioxidants, are considered by nutritionists a second-class alternative to eating the real thing.

At the beginning of this section, we warned that there were two sides to the message of 'drink plenty of water'. The new side is an emerging story with sad consequences. As is often the case in nutrition, it is possible to misinterpret good advice so that it becomes dangerous. Many health-conscious people seem to have become 'welded' to a drink bottle, continually swigging down fluids during work, study and other activities. This might be a good practice for athletes with very heavy training programs in hot weather who need to replace litres of fluid each day. But what about moderately active people who spend most of the day in air-conditioned comfort? We used to think that the worst consequence of drinking too much fluid was a frequent need for toilet breaks. But it seems we now need to publicise the fact that drinking too much fluid can be life-threatening.

When fluid is consumed at a rate that outstrips the capacity of your kidneys to produce urine, blood constituents, including sodium, can be diluted. At extreme levels, this condition (called hyponatraemia) can lead to confusion, irritability, coma and death. It used to occur, rarely, in people who had psychological problems that caused them to drink large volumes of fluid. More recently it has shown up as a result of 'odd' behaviour, such as participating in a radio competition to see who can drink the most fluid before they have to wee. Worryingly, it has been reported in marathons and Ironman triathlons among well-meaning recreational competitors who thought they were doing the right thing by drinking large amounts in the days leading up to the race, and making further excessive use of the aid stations during their event. Such exaggerated behaviour and its potentially fatal outcomes are still relatively rare, but they are completely preventable. The guidelines in Checklist 1.5 should help you to find a healthy balance with your daily fluid intake. More

information about drinking during and after exercise sessions is found in Chapters 2, 4 and 5.

1.5 Look after your electrolytes ('salts')

Sodium is the most important electrolyte found outside the body's cells, while potassium is its 'counterweight' inside the cells. The sodium concentration helps to regulate blood pressure and volume, and assists in balancing the distribution of fluid and nutrients between the inside and outside of cells. When the sodium concentration falls outside its normal range, the delicate balance is disturbed and body function is impaired. (In the previous section we heard that low blood sodium levels, arising from excessive fluid intake and the resulting dilution of all blood contents, can be fatal.)

Fortunately, your body has a fairly complex system involving your kidneys and thirst to regulate how much sodium and water are taken in and how much of these and other electrolytes (potassium, chloride, etc.) are excreted in urine. Electrolytes, particularly sodium, are also lost in other body fluids, particularly sweat. Massive losses of sweat can potentially deplete the body's electrolyte stores. But with training and acclimatisation, it can adapt to a hot environment by diluting sweat and thus conserving electrolytes. It then 'expects' you to replace net losses through your diet. In this way, within a broad range of challenges the body can manage its electrolyte levels quite well. However, the life of an athlete isn't always a series of gentle challenges, and you may at times throw your body into some extreme situations. Either heavy loss of electrolytes or excessive intake of them can threaten your vital electrolyte balance.

The more common problem is one of overconsumption, and the usual suspect is sodium. In fact, eating patterns in Australia and other Western countries make excessive salt intake almost unavoidable. Sodium, like the other electrolytes, is found naturally in many foods. However, our dietary patterns have distorted our sodium intake through the addition of large amounts of salt (sodium chloride) to our foods and our meals. Other sodium compounds include MSG (monosodium glutamate), sodium bicarbonate, and some vitamin C tablets (sodium ascorbate). Our kidneys generally manage our excess intake of sodium

by excreting it in urine. However, one in five people will develop high blood pressure. Overdosing on salt also interferes with calcium balance and can thus contribute to lowered bone density in those at risk. Since we don't always know who is at risk for these problems until it is too late, nutrition guidelines encourage all Australians to moderate their salt consumption.

Athletes who sweat a lot are one of the few groups of people who may need to deliberately consume salt. Particular athletes may be at risk of salt depletion if they experience very large sweat losses in hot weather, particularly if they are 'salty sweaters' (people whose sweat contains a high concentration of sodium). These athletes may need to use electrolyte-containing drinks during and after exercise, as well as adding a little extra salt to their post-exercise meals. This is mentioned in Checklist 1.6 and covered in more depth in Chapter 4 (Competition nutrition) and Chapter 5 (Promoting recovery).

1.6 Using alcohol sensibly

Alcohol can be an enjoyable part of most lifestyles, including that of an athlete. It is hard to think of a celebration without champagne—and hopefully you will have many sports successes to celebrate! The issue with alcohol is how well you use it, and unfortunately, in some sports alcohol is used very badly. Despite many campaigns and 'player conduct codes', the newspapers still print plenty of stories about the antics of football players, cricketers and other athletes who get drunk after competition, in the off-season, or on the post-season trip. These binges may result in trips to jail, brawls and domestic violence, car accidents, and, on unfortunate occasions, death. Even if it doesn't hurt your body, drinking to excess could hurt your reputation and 'market value' to sponsors and others.

A nutrition textbook will warn you about the health and social consequences of alcohol abuse, including its contribution to the annual road toll. For most athletes, however, cautionary tales about liver cirrhosis seem of little relevance. But drinking doesn't have to reach the level of serious abuse or alcoholism before it affects sports performance. With this in mind, we shall consider alcohol's effects solely from the viewpoint of exercise.

The immediate effects of drinking alcohol include dilation of blood

vessels (vasodilation) and depression of the central nervous system. As a result, you will feel a little flushed (losing more heat through your skin) and your sensitivity will be dulled. So while you may think you are giving a great performance, be it in the disco or on the playing field, in fact your judgement, coordination and vision will be impaired. The severity of these effects will depend on how much alcohol you drink and on your individual tolerance (note that females tend to have poorer tolerance). However, most people will experience the initial effect after consuming 20–30 g of alcohol. Figure 1.1 illustrates the alcohol content of various drinks.

Alcohol does not help with fluid replacement—in fact, it acts as a diuretic and may reduce the rate at which you are rehydrating. And despite what you may have heard about carbo-loading with beer, alcoholic drinks will not top up your muscle glycogen stores. Most of the kilojoules in alcoholic drinks come from alcohol, not carbohydrate. Furthermore, alcohol is high in kilojoules—29 kJ, or 7 Calories, per gram (see Chapter 2)—and can quickly cause an energy surplus. It seems to promote the deposition of body fat, especially around the abdomen.

The bottom line is that alcohol should not be consumed just before or during exercise. The penalties for heavy intake at such times include poor hydration, lowered fuel stores, impaired skills, poor sleep and a greater risk of hypothermia in a cold environment (heat loss through the skin will interfere with normal temperature regulation). After exercise, alcohol intake should not compromise your recovery goals. You should follow your nutrition plans for rehydration, repair and refueling before you consider drinking alcohol. You should also weigh up the effect of alcohol on recovery from injuries. The standard treatment for soft-tissue injuries and bruising is to ice and elevate the affected area to constrict blood flow to it. The injured athlete who consumes alcohol immediately after the event may cause extra swelling and bleeding, delaying recovery and in some cases even exacerbating the damage. The most sensible choice for an injured athlete is to avoid any alcohol in the 24–48 hours post exercise.

So should you worry about occasional alcohol binges—or perhaps the weekly post-match 'wind-down'? The answer is that even a single episode of excessive intake will cause some damage. In particular, it will delay recovery and injury repair after exercise. Slow recovery could be

crucial if your next competition is a day or even a week away and catches you at less than your best. Even if competition is some time away, you should consider whether your next training sessions will be disrupted and whether you can afford this.

The real problem with alcohol occurs when drinking binges are repeated, as often occurs after weekly matches in team sports. Repeated bingeing will slowly but surely erode your skills, your fitness and your sports career. That is a fact—even if everyone on the team does it and it appears to be normal (or desirable) behaviour. Another thing to remember is that alcohol is high in kilojoules and low in nutritional value. Heavy consumption and bingeing will lead to weight gain. Have you noticed how much heavier you are on your return from the end-of-season trip?

Alcohol is not 'sweated out' or 'exercised off'—these are just more of the locker-room tales that help to sustain alcohol misuse in sports. It is a drug that, at high levels, causes damage to many organs and tissues in your body. The only way to prevent this from happening is not to drink to excess. That said, alcohol can be a small part of a healthy diet. A drink after a hard day's training can help you relax, and a few drinks can add sparkle to social occasions. If you choose to drink, make it work for you, rather than letting it lower your sports potential to the level of those who would have you believe that 'team bonding' (getting drunk together) is all that sport is about. Checklist 1.7 provides hints on how to drink sensibly for sport.

CHECKLIST 1.1
Are you achieving your peak training diet?

- Do you meet the energy and fuel requirements needed to support your training program?
- Can you achieve and maintain body weight and fat levels that are good for your long-term health and performance in your sport?
- Do you refuel and rehydrate appropriately during key training sessions to perform optimally at each session?
- Do you promote recovery between training sessions with practices that will rapidly replace fluid and fuel stores and all the nutrients that enable the body to adapt to the training load?
- Do you provide your body with all its nutrient needs, remembering that requirements for some nutrients will be increased by a strenuous training program?
- Do you reduce your risk of getting ill or injured by consuming the energy and nutrients that maintain good health?
- Do you create opportunities in training to try out your competition eating practices (such as the pre-event meal, or eating and drinking during an event)? Practice makes perfect and can help you identify many of the things that could go wrong on the big day.
- Do you make well-considered decisions about the use of supplements and specialised sport foods that have been shown to enhance training performance or meet training nutrition needs?
- Do you think about the future? Do you take into account the nutrition guidelines for long-term good health? (Not only will this affect the quantity and quality of your own life, but others who admire your sporting achievements may follow suit.)
- Does food provide pleasure in your day? Are you able to enjoy social eating opportunities with your family and friends?