# 001

DOWN TO BASICS

Eating a wide variety of commonly available foods is one of the most effective ways of ensuring we can meet our carbohydrate, protein and fat requirements for general good health – and to operate effectively as athletes.

In this chapter you will find out:

- Good health is highly dependent on a healthy balanced diet – even more so as an athlete!
- As an athlete it is even more essential that you meet your body's needs for nutrients – and you can do this by eating a wide variety of foods. Variety is key
- The body's primary energy fuel is glucose – and carbohydrates, sugars and starches are eventually digested and converted to glucose
- It is important to choose protein-rich foods which can provide all the essential amino acids
- The diet of an athlete requires some dietary fat – in order to provide essential fatty acids and fat soluble-vitamins

# 001
DOWN TO BASICS

Nutrients that the body needs are provided by the food we eat – but it is important to realise that no one specific food or food group alone is sufficient to provide all the nutrients needed for good health and successful performance out on the road, track or field. Eating a good variety of foods including fruits and vegetables, will play a big part in ensuring there is an adequate supply of vitamins, minerals and dietary fibre.

The energy supply that allows us to run, jump, throw and push is derived from the nutrients found in various foods that we eat. These are broken down in the body and converted to provide energy – a measurement called Kilocalories (kcal). This measurement, which can often be seen on the side of food and drink labels, is used to show how much energy different types of nutrients can provide per gram e.g.

- Carbohydrates can provide 3.75 kcal per gram
- Proteins can provide 4 kcal per gram
- Fat can provide 9 kcal per gram
- Alcohol can provide 7 kcal per gram

## A BIT ABOUT CARBOHYDRATES

Dietary carbohydrate can be found in a wide variety of carbohydrate-rich food and drink. Both types of carbohydrates (sugars and starches) are converted into glucose, which is then absorbed into the blood, providing the primary fuel for the body's energy. Foods high in carbohydrates have a wide variety of metabolic, functional and nutritional features and are best explained by classifying them into three main groups:

1 Monosaccharides: single molecules of sugar. The monosaccharides are:
- glucose – found in most carbohydrate foods including sugars and starches. All

carbohydrates are eventually digested or converted into glucose

- fructose – also known as fruit sugar. This is found in fruits, vegetables and honey and is converted into glucose by the liver
- galactose – this is part of lactose – the sugar that is found in milk

2 Disaccharides: two linked sugar molecules which are broken down by the mono-saccharides by digestion. The disaccharides are:

- sucrose = (glucose + fructose). Sucrose (table sugar) which mainly comes from sugar beet/sugar cane can also be found naturally in all fruits and vegetables and most herbs and spices
- lactose = (glucose + galactose). Lactose is found in milk and milk products
- maltose = (glucose + glucose) maltose is formed when starch is broken down

3 Starches: starch, also known as polysaccharide, is hundreds of molecules of glucose joined together. When starch is digested, it is initially broken down into maltose and then into glucose.

IN SUMMARY

The major differences between sugars and starches is the size of molecule. However, you will find that foods are mainly classed according to the major type of carbohydrate they are made up of. As a result, this has led to the simplistic division of carbohydrate-containing foods into two categories:

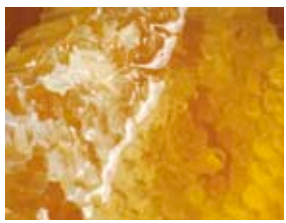
Simple:
mainly consisting of sugars

Complex:
mainly consisting of starches

This over-simplification is confusing as the majority of naturally occurring foods contain a mixture of sugars and starches as well as other nutrients.

As most of the carbohydrates will end up being converted to glucose, it is not accurate to regard one type as "better" than another. Therefore other factors need to be considered – particularly by athletes – as to which carbohydrate may be more practical: e.g. one where the carbohydrate is converted to glucose quickly or one where it takes more time, the type of food you need to consume and where it fits into your training and competition schedule.

Later in this guide you will find more information on how to use carbohydrates effectively to fuel athletics performance and training.



# 001
DOWN TO BASICS

## ABOUT PROTEIN

Protein is essential for living and within the body there is a continual process of protein turnover – they are continually broken down and formed as the body uses it to grow and repair tissue.

The largest store of protein is within your muscle. However there is only a very limited capacity to store newly created proteins – therefore protein intake which is in excess of your body's requirements is broken down to provide energy – or stored as fat or carbohydrate. During digestion, proteins are broken down into smaller units called amino acids which can be further combined into a vast array of different proteins. Our bodies are able to create proteins from amino acids – but there are nine essential amino acids the body is unable to produce so these must be supplied in adequate amounts from our diets.

The semi essential amino acids can be made by the body providing the essential amino acids are present in sufficient amounts within the diet – see table on the right.

## WHERE TO FIND IT

Only some foods, known as complete protein foods, contain all the essential amino acids. As a general rule, foods from animal sources contain large amounts of all the essential amino acids, however foods from other sources can be combined with each other to create complete protein foods. Plant products + dairy products = improved protein quality. The table on the right gives examples of protein-rich foods or combinations of foods that provide all the essential amino acids in sufficient amounts.

Later in this guide you will find more information on the protein content of certain foods, the protein needs of an athlete, and also how to address protein requirements in a vegetarian diet.

| Essential |
| --- |
| Histidine |
| Isoleucine |
| Leucine |
| Lysine |
| Methionine |
| Phenylalanine |
| Threonine |
| Tryptophan |
| Valine |
| **Semi essential** |
| Cysteine – needs Methionine |
| Tyrosine – needs Phenylalanine |
| **Non essential** |
| Alanine |
| Arginine – essential for infants |
| Aspartic Acid (Asparagine) |
| Glutamic Acid (Glutamine) |
| Glycine |
| Proline |
| Serine |

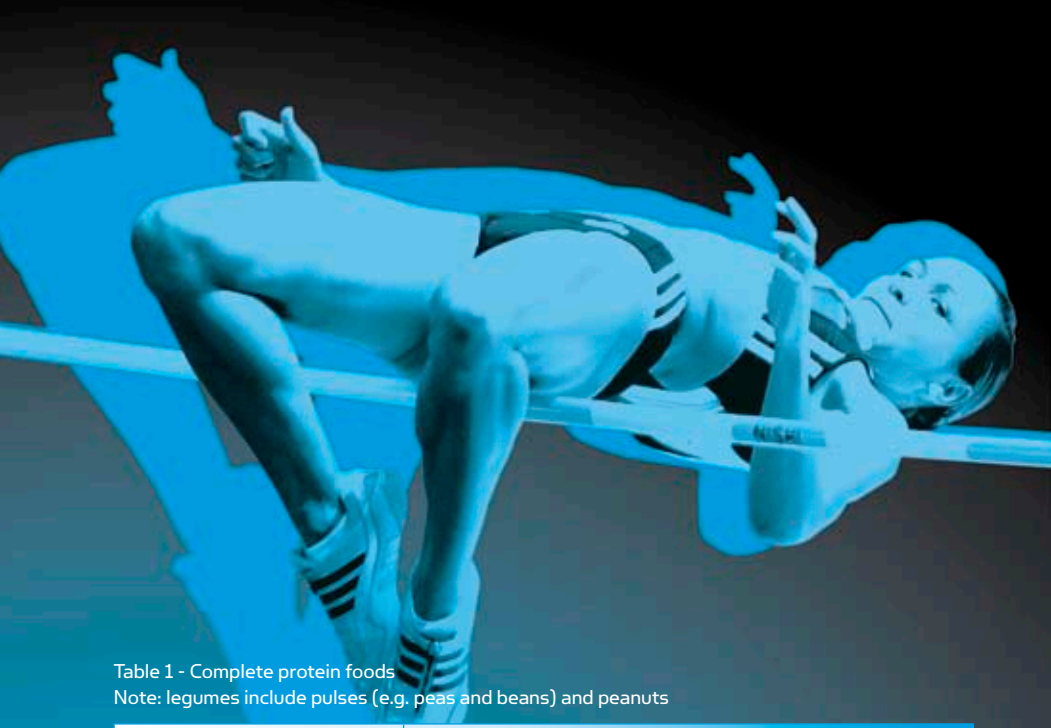


Table 1 - Complete protein foods
Note: legumes include pulses (e.g. peas and beans) and peanuts

| Type | Example |
|---|---|
| Dairy products | Milk, yoghurt |
| Eggs | Boiled, scrambled, omelette |
| Fish | Fresh or tinned, e.g. salmon, tuna |
| Meat and meat products | Beef, lamb, ham, sausages |
| Poultry | Chicken, turkey |
| Grains plus legumes | Bean curry or lentils with rice, peanut butter sandwich, bread with hummous, baked beans on toast |
| Grains plus nuts or seeds | Muesli mix with oats and nuts or seeds, e.g. hazelnuts or sunflower seeds; rice salad with nuts, e.g. walnuts, sesame seed spread (tahini) on bread |
| Legumes plus nuts or seeds | Mix of peanuts and nuts, e.g. cashews |
| Grains plus dairy products | Breakfast cereal and milk, rice pudding, pizza or pasta with cheese, cheese sandwich |
| Legumes plus dairy products | Bean curry in a yoghurt based sauce, bean chilli with cheese |

# 001
DOWN TO BASICS

## A MATTER OF FAT

Obviously eating large amounts of fat is not recommended! But fat should be included in our diet to some extent as it can provide us with essential fatty acids and fat soluble vitamins such as Vitamin A, Vitamin D, Vitamin E and Vitamin K.

- Fat can be used as an energy source – it is stored in the muscles.
- It is found in many foods which need to be included in a healthy balanced diet – and avoiding these foods could lead to nutrient deficiencies. e.g. dairy products can be regarded as high in fat – however they are a valuable source of protein, and calcium, not to mention vitamins and minerals.

So... if fat intake needs to be reduced there are ways to consume low fat options – without avoiding the food group completely!

## FATTY ACIDS

Dietary fat is composed of three kinds of fatty acids:
Saturated fatty acids (SFA)
Monosaturated fatty acids (MUFA)
Polyunsaturated fatty acids (PUFA)

Typical dietary fat will contain a mixture of both saturated and unsaturated fatty acids (MUFA and PUFA). Different foods have varying levels of fatty acids, but generally:
Meat, dairy products, coconuts =
high in saturated fatty acids (SFA)
Olive oil, rapeseed oils =
high in monosaturated fatty acids (MUFA)
Sunflower oils, Soya oils =
high in polyunsaturated fatty acids (PUFA)

## ESSENTIAL FATTY ACIDS (EFA)

Essential fatty acids are a sub group of polyunsaturated fatty acids. Our bodies cannot make these acids and therefore need to be supplied in adequate amounts from within the diet. The two classes of EFA are:

**Omega 3 – can be found in:**

- Oily fish, e.g. salmon, mackerel, herring, sardine, pilchards and tuna in oil
- Linseed and pumpkin seeds
- Oils, e.g. soyabean and rapeseed oil
- Walnuts
- Sweet potato

**Omega 6 – can be found in:**

- Seeds, e.g. sunflower and sesame seeds
- Nuts
- Oils, e.g. sunflower oil, safflower oil, corn oil, groundnut oil, sesame oil, rapeseed and soya oils
- Polyunsaturated margarine

Intake of Omega 6 PUFA is required – but not to excessive levels as this can lower the levels of the protective HDL cholesterol! The focus should be mainly on Omega 3 PUFA. General recommendations in this area are that we aim to consume at least two portions of fish per week with one of these portions being oily fish to ensure we provide our bodies with an adequate supply of Omega 3 Essential Fatty Acids.

## CHOLESTEROL

Moderate fat diets where the fat is provided predominantly by MUFA and PUFA, and SFA is kept to a low level, can help reduce cholesterol levels – particularly the harmful LDL cholesterol.

A very low fat diet can achieve the same results, however it may also reduce the levels of protective HDL cholesterol.

### Down to the fat of the matter...

So, as an athlete, the amount of dietary fat needed will depend on several different factors including:
Age
Gender
Body size
Training levels
Energy requirements

If you decide you need to reduce your fat intake, then there are quite a few adjustments you can make to your everyday habits which will ensure your overall diet remains balanced and is providing all the nutrients your body requires to cope with the training loads you need it to withstand.

Opt for lower fat options – keep dairy products within your diet but opt for semi skimmed milk or low fat yogurts. Change preparation methods – trim the visible fat off meat and choose leaner cuts of meat.
Change cooking methods – grilling instead of frying.
Increasing carbohydrate has been shown to reduce fat intake – however avoid putting butter, cream and cheese on pasta, baked potatoes and bread as this would no doubt raise fat intake once again!

## DON'T GET CAUGHT OUT

Food labelling can sometimes be confusing – many foods will be labelled as follows – so make sure you know what they mean:

Fat Free: Something labelled as fat free must contain less than 0.15g of fat per 100g/100ml of the product. E.g. less than 0.15% fat.

Low Fat: A product labelled as low fat must contain less than 3g of fat per 100g/100ml. E.g. less than 3% fat.

Reduced Fat: If food is labelled as reduced fat it must contain at least 25% less fat than the standard product in the same range.

Reduced/low or fat free products do not always equate to low calories! Calories may still need to be considered as some products which may be low fat may still be high in calories e.g. low fat sausages, low fat muffins etc.

Be careful with portion sizes! low fat foods are only effective if you maintain sensible portion sizes.

# 001
DOWN TO BASICS

## LET'S DRINK TO THAT...

As an athlete, it is likely that alcohol will not be a regular feature in your diet. That's not to say it cannot be enjoyed in moderation, but each athlete needs to ask themselves how and when it should be part of their intake – if at all. Many world class athletes completely avoid alcohol, some will use it as an occasional treat. Either way, it is important that as an athlete you can appreciate the facts, so that you can make an informed opinion.

## REASONS FOR AVOIDING ALCOHOL

- Long term heavy drinking causes liver damage and other associated problems
- In the short term, excessive amounts can be toxic and endanger the lives of others (e.g. loss of control and irresponsible behaviour such as drink driving)
- Even small amounts can interfere with skilled performance in sport, affecting balance, judgement and strength
- Alcohol causes dehydration and can slow down the process of rehydration
- Alcohol can slow down the rate of tissue repair and growth. Therefore it should be avoided in the immediate aftermath of heavy training or competition and in particular alcohol should be avoided for at least 24-48 hours following any soft tissue injuries
- Alcohol is a high energy – low nutrient food. It is not filling so therefore you will still feel hungry despite having already consumed a high proportion of calories – therefore it may displace other nutrients and cause an increase in body fat

Guidelines exist for sensible drinking to limit health risks associated with alcohol. Quantity guidelines are expressed as units: 1 unit of alcohol = 8g of alcohol equivalent to:

- a single measure of spirit (25ml)
- a 50ml measure of fortified wine e.g. sherry or port
- a 100ml (small glass) of wine
- half a pint of standard strength beer, lager or cider (3.5% alcohol levels)

Current guidelines suggest daily intakes should not exceed 3-4 units for men or 2-3 units for women (and not exceed 1 unit a day for a pregnant woman). Later in this guide you will find information on rehydrating properly following training and competition.

So what have you learned so far?

- Healthy eating is about balance and variety, not good or bad foods
- Every person has different energy requirements which need to be addressed through their dietary choices
- Eat more carbohydrates (especially cereal and starchy sources)
- Eat a moderate amount of protein
- Try to eat at least five portions of fruit and vegetables each day
- Eat less fat, choose lower fat options and the right kinds of fat!
- Try to eat two portions of fish each week – one of which should be oily
- Avoid adding fats to food
- Alcohol should be consumed sensibly, within guidelines... if at all

# 002
ENERGY

Whatever you do – whether it is rest, training, competing or simply recovering from your season with a holiday, you require energy.

In this chapter you will find out:

- How important it is to have the right amount of energy and how too much or too little can be detrimental to health and athletics performance
- Body weight is not an accurate way of measuring energy balance or macro-nutrient (carbohydrate, protein and fat) balance
- All athletics events will have a specific optimal physical body size, body composition, and fuel stores to maximise athletics performance
- Some reproductive disorders in athletes are not caused by the stress of training, but by low energy availability

# 002
ENERGY

As athletes your ability to draw on energy and replace it effectively is essential – and when you are in training or competition this of course can make a massive difference to your level of performance. However as with any part of your sporting routine, a key factor is ensuring you achieve the right balance.

Too much energy – and body fat increases – performance may be compromised. Too little energy – there is insufficient energy to perform – health and athletics performance are compromised.

In many athletics events weight is a consideration – endurance is a key area where a low body weight can help performance but this is also an area that demonstrates how important it is to get the balance right. An insufficient intake of energy could result in a lower body weight and this decreased energy could compromise the athlete's health and performance.

Energy for exercise comes from the food and drink we consume. Some of the energy is used immediately, but most is stored by our bodies for later use: Fat is stored as fat. Protein is stored as protein. Carbo-hydrate is converted to glucose then stored as glycogen.

## ENERGY SYSTEMS

Different energy systems are needed for different types of activity. In athletics the contribution of the different energy systems for sprinting will vary compared with those used during a steady run.

### What happens:

When we need energy our bodies break up a substance called ATP (Adenosine Triphosphate). ATP is a molecule which consists of three phosphates attached by

energy bonds to adenosine. When one phosphate is broken off, ADP is formed (Adenosine Diphosphate) and energy is released in this process. The ADP is then converted back into ATP and the cycle continues.

There are three systems in the body that create ATP energy. All three work simultaneously, however the contribution each one makes varies according to the type of activity which is taking place, the intensity and the duration.

### ATP – CP

Also known as "the sprint system" in that it provides enough energy for a 5-6 second sprint effort and doesn't require oxygen – therefore making it anaerobic. Creatine Phosphate (CP) is a high energy molecule where the phosphate can be broken off very quickly – releasing energy – and used to convert ADP back to ATP. Muscles do not store a large amount of CP, and as a result it is used up fast.

Later in this guide you will find more information on the use of supplements – including creatine supplements, which have become popular in the hope that the body's creatine muscle stores can be maximised.

### ANAEROBIC

Known as the "high power system", this can provide energy for a 90 second power burst. This system is the fast anaerobic (without oxygen) breakdown of glucose for energy but only provides 2 molecules of ATP along with the waste product called lactic acid – too much of which will cause muscle fatigue.

### AEROBIC

Also known as the "endurance system" – how long you can keep it going depends solely on how fit you are! This system is the slow aerobic (with oxygen) breakdown of glucose for energy and can provide 38 molecules of ATP - which is nearly 20 times more than that provided by the anaerobic system. The aerobic sysytem can also use fat to produce ATP energy. A benefit of endurance training is that it makes the muscles use fat more effectively and as a result helps to conserve limited glycogen (carbohydrate) stores.

### ENERGY FUEL

Carbohydrate, fat and protein are the three main energy fuels for exercise. Each of these nutrients are found in differing amounts in foods and are broken down in the body.

As covered in chapter one – Down to Basics: carbohydrates can provide 3.75 kcal per gram. Proteins can provide 4 kcal per gram. Fat can provide 9 kcal per gram.

From that you can see that 1g of fat releases more than twice the energy as 1g of carbohydrate – however, this doesn't mean it is the best source of energy for fuelling your training regime!

# 002
ENERGY

## WHAT FUEL AND WHEN

The amount of each type of fuel, whether it be carbohydrate, fat or protein that you use during training depends on a number of different factors including:

- type of training/ competition activity
- training/working intensity
- duration of the training session/competition
- frequency of training sessions/race/competition
- fitness level
- dietary intake

## CHANGING INTENSITY

During low intensity exercise (the sort which burns less than 300kcal per hour), the body uses a greater proportion of fat, a smaller proportion of glucose and fewer calories.

As exercise intensity increases the body gradually uses more glucose and more energy (calories). Therefore, most of the fuel during moderate and high intensity work (burning more than 500kcal per hour) will come from glucose.

Exercising aerobically for a longer period means that the body will gradually use more fat and less carbohydrate – attempting to conserve the limited carbohydrate stores.

As a general rule, the fitter you are the more efficiently muscles can use fat as an energy fuel, lengthening the amount of time you can train for.

| Type of activity | Type of fuel | Comment |
|---|---|---|
| Anaerobic activities | Carbohydrate | |
| Aerobic activities | Carbohydrate, fat and protein | Protein is used to a lesser extent than carbohydrate and fat |

## IT'S A BALANCING ACT

So the energy we take in from food and drink needs to provide for our immediate energy needs as well as influencing our body's energy stores. Energy stores themselves can also have an effect on performance.
In athletics, every athlete will have event specific requirements for their body size, shape and composition.

Sprinters, jumpers and throwers: in competition, have no use for fat stores. Endurance runners: need some fat for fuel.

The outcome of differing needs is that athletes will often attempt to alter their body size, composition and fuel stores in an attempt to achieve the characteristics they believe will be advantageous to performance.

However, it is important to note that body weight in itself is not a good indicator of an athlete having a good energy or macronutrient (carbohydrate, protein and fat) balance, because it is not able to distinguish between changes in body fat or muscle mass, or to see whether total energy intake provides for optimal fuel stores.

## MACRONUTRIENT BALANCE

Macronutrients (carbohydrate, protein and fat) are metabolised differently and stored separately. Therefore in order to achieve the best body size, composition and energy store to benefit performance, your macronutrient intake needs to be managed separately too. E.g. excess fats are generally stored, excess carbohydrate is mostly used up and excess protein is also mostly used up.

In order to lose body fat, a negative energy balance and a negative fat balance is required:

Reduced intake of fats + increased burning up of fats by training = negative energy/ fat balance.

However, it is important to remember that as lean muscle mass may increase as the body fat is declining – the reduction in body fat may not necessarily result in a reduction of energy intake, energy balance or body weight.

In order to increase lean muscle mass, a positive energy and positive protein balance is required:

Increased energy intake including an increased intake of protein with sufficient carbohydrate + specific muscle building exercises = increased lean muscle mass.

## MANAGING YOUR ENERGY

Therefore it is clear that your different energy stores need to be managed separately, with each element needing separate consideration. In order to perform to your optimum as an athlete, your eating strategy needs to be as specific to your body size and composition alongside your training and competition goals.

### So remember:

Appetite is not the best guide to nutritional and energy intake! If in doubt, seek advice from a sports nutrition professional who can assist by developing an individual plan.

To ensure you are able to monitor your progess toward achieving your goals, there are a number of separate bio markers that can act as indicators:

- body weight
- skinfold thickness – can help monitor changes in body fat stores
- changes in muscle strength and endurance capacity
- testing urine for urinary ketones (dipsticks available from chemists) can provide an indication of inadequete carbohydrate intake

# 003

ESSENTIAL FUELS FOR
TRAINING & RECOVERY

The most effective way to improve in sport is to be able to maintain a level of consistent and effective training, which requires you to be able to recover sufficiently between sessions. As the most required fuel, carbohydrate is essential to this process, and it is essential that it is restocked as the body's stores are limited.

In this chapter you will find out:

- The most important food for energy is carbohydrates
- Athletes should aim to make carbohydrates the main part of their diet during training and competition
- Recovery from training is the key to sustained, consistent training
- An athlete needs to ensure that their stores of carbohydrate are restocked in between sessions in order to recover
- Refuelling should be trained for almost as much as your event – refuelling and recovery should not be new ground come an important competition!

# 003
ESSENTIAL FUELS FOR TRAINING & RECOVERY

As discussed in the last chapter, carbohydrates, proteins and fat are the three main energy fuels for exercise. However, the preferred energy fuel for the muscles is glucose, particularly as exercise intensity increases.

Glucose is formed from the breakdown of carbohydrates and is stored as glycogen within the liver.

However, carbohydrate stores within the body are relatively small and so need to be topped up daily or even more frequently. By not restocking glycogen stores correctly, fuel will run out after only a few days of training and the athlete will find performance is compromised as fatigue sets in.

## BASIC ADVICE AND SIMPLE GUIDELINES

- The amount of carbohydrate you need depends on your level of training
- The more intense your programme, the more carbohydrates are needed
- More glucose used, the more carbohydrates you need to ingest in order to restock
- In order to maintain training loads, you need to make sure you replace carbohydrates effectively and accurately – not replacing enough will be detrimental to performance on track, road or in the field
- The best way to work out levels of carbohydrates needed is to work on the grams required per kilogram of body weight – this is an accurate way of representing the fuel needs of the muscle
- Using this information you can plan your diet to meet those targets accurately and remove the "guess factor" that some athletes rely on

See table 2 for guidance on the grams per day you should be ingesting which is calculated from your bodyweight.

Bodyweight is an essential part of calculating carbohydrate needs of different athletes, as is careful monitoring of the intensity and length of the training or competition. Knowing how hard you are training and being realistic with this is essential in getting this strategy right and accurate refuelling. Table 3 below demonstrates how these different factors make a large difference in the amounts of carbohydrate needed.

However, in the same way that athletics is an individual sport, each individual's needs will be slightly varied, and whilst the table below demonstrates recommendations, each athlete needs to assess how well they perform and train under certain carbohydrate levels and use this to determine whether they are taking in enough.

Table 2 - Carbohydrate recommendations for training

| Training level | Carbohydrate (g/kg/d) |
|---|---|
| Regular levels of activity (3-5 hrs/week) | 4-5 |
| Moderate duration/low intensity training (1-2 hrs/day) | 5-7 |
| Moderate to heavy endurance training (2-4+ hrs/day) | 7-12 |
| Extreme exercise programme (4-6+ hrs/day) | 10-12 |

Table 3 - Range of carbohydrate needs

| Athlete's body weight in kg | Training level moderate duration and low intensity | Moderate to heavy endurance | Extreme exercise programme |
|---|---|---|---|
| 40 | 200-280 | 280-480 | 400-480 |
| 50 | 250-350 | 350-600 | 500-600 |
| 60 | 300-420 | 420-720 | 600-720 |
| 70 | 350-490 | 490-840 | 700-840 |
| 80 | 400-560 | 560-960 | 800-960 |
| 90 | 450-630 | 630-1080 | 900-1080 |
| 100 | 500-700 | 700-1200 | 1000-1200 |
| 110 | 550-770 | 770-1320 | 1100-1320 |
| 120 | 600-840 | 840-1440 | 1200-1440 |
| 130 | 650-910 | 910-1560 | 1300-1560 |

# 003
ESSENTIAL FUELS FOR TRAINING & RECOVERY

## CARBS GLORIOUS CARBS

Carbohydrates are the sugars and starches ingested in the diet. But man does not live on bread alone – and it is essential to make sure other foods are added to meals and snacks to ensure protein and other nutrients are provided.

The majority of your carbohydrate intake will come from cereals, potatoes, rice, pasta and bread, plus peas, beans and lentils. Most carbohydrates are broken down into glucose so one will not be better than the other, therefore practicality may play a part in the type of carbohydrates you ingest. E.g. rice, potatoes and bread are bulky and may not be easy to ingest as a pre-event snack or in large quantities post competition. Training also may have been so intense that the amount needed to refuel is simply not palatable to an athlete.

In these situations, sometimes is it useful to be able to source carbohydrates from other foods such as sugary foods and snacks, fruits and juices, which provide a concentrated hit of carbohydrate.

### Monitoring carb levels:

Food labels will often tell you how much carbohydrate, per 100g and per portion that it contains, but as a quick example some everyday foods and the carbohydrate content for a medium portion are in table 4 below.

The key thing to remember though as an athlete is that needs will vary widely according to event, gender, bodyweight and intensity of work. Factsheet 1 demonstrates the varying needs of three athletes and the types of foods they would need to take in to meet their carbohydrate requirements. It is important to note that these menus are not representative of a fully balanced diet as the only foods listed are carbohydrate sources.

Table 4 - Carbohydrate content of everyday foods

| Medium portion of food | Carbohydrate (g) |
|---|---|
| Baked potato, pasta or rice | 60 |
| Bagel, flapjack or slice of fruit cake | 40 |
| 1 large banana or 50g raisins | 35 |
| 2 slices of bread, 2 crumpets or 1 bread roll | 30 |
| Muesli, cornflakes, 2 Weetabix or cereal bar | 30 |
| 50g chocolate, 10 jelly beans or 3 jaffa cakes | 30 |
| 500ml sports drink or squash | 30 |
| Baked beans (135g) or sweetcorn (100g) | 20 |
| 200ml orange or apple juice | 20 |
| Apple, pear, orange or 2 kiwi fruit | 15 |
| 2 tsp honey or jam or 150g low fat yoghurt | 15 |

## THE GI QUESTION

One of the ways that carbohydrates can be categorised is by the speed at which is it converted into glucose – this measurement is the Glycaemic Index or GI.

A food's GI is a measure of how the food affects the body's blood glucose after consumption – the larger the rise in blood glucose the higher a GI score it has.

Although GI should not be thought of as the complete or only way of ranking a carbohydrate food's merit, carbohydrates with a moderate to high GI provide an excellent source of carbohydrate for glycogen storage and therefore it is recommended they are the fuel of choice in recovery snack and meals, the best way to refuel after a session or competition.

Foods are divided into 3 GI categories – low, moderate and high GI. However, there is no obvious way of identifying a food's GI by its appearance. Some sugars have a high GI (glucose), others have a low GI (fructose). Some starches have a high GI e.g. baked potato and some have a low GI e.g. pasta. Low GI foods are not bad, however they often contain higher levels of dietary fibre than high GI foods, can be more bulky and therefore proportionally more food is consumed in order to refuel muscles than high GI foods.

Factsheet 2 outlines different types of foods and their GI levels.

# 003
ESSENTIAL FUELS FOR TRAINING & RECOVERY

## WHEN TO CARB... BEFORE, DURING AND AFTER

So far, the factors you need to consider in relation to carbohydrates are:

- the amount you need
- when you need it
- what sort of carbohydrate to choose
- whether to add other nutrients

All of these factors can enhance glycogen recovery and improve the practicalities of carbohydrate intake targets. But ultimately, as an athlete you have to make sure you work out the most effective fuelling strategy and ensure any variations in routine are tested in training and not during a competitive cycle. This is most important in relation to ingesting carbohydrates before and in the case of certain athletics events during activity and the considerations will in many cases be event specific. Factsheet 3 contains a number of carbohydrate snacks providing approx 50g of carbohydrate, for consumption before or after a session or competition.

### CONSIDERATIONS FOR BEFORE TRAINING AND COMPETITION

Although chapter seven deals in more detail about preparing for events and planning nutrition, generally speaking, a snack high in carbohydrates approximately 30-60 minutes before training, can be beneficial to some, providing enough carbohydrate is eaten – particularly for athletes who require fuel mid exercise but may not be able to take on board fuel during the session.

However, it is also the case that some athletic events are not conducive to eating soon before. It is also wise to ensure that any food close to competition is just snack sized (containing around 50-100g of carbohydrate), as a meal can take in excess of 2-4 hours to be digested.

High GI food is probably the best option, although if – as is the case with marathon runners – an athlete has the capacity to refuel mid event then the GI of the pre race snack is not as important. Other factors may then need to be considered such as the amount of bulk (fibre-content) in the selected snack and whether it will cause stomach problems. Therefore, high fibre options would be best avoided.

### DURING TRAINING AND COMPETITION

For refuelling during an event, a key factor that will determine levels will be the duration of the exercise:

Up to an hour – the athlete's own choice as to whether they

- have nothing
- have water
- have water and some carbohydrate with or without salt. It is thought that 30-60g per hour will maintain glucose levels

Intense exercise lasting longer than an hour, i.e. brings about fatigue

- highly recommended to have 30-60g of rapidly absorbed carbohydrate (high GI) per hour
- best to ingest gradually, taking regular smaller feeds which maintain a steady flow of glucose fuel
- carbohydrate in the form of glucose, sucrose, maltodextrins and high GI starches recommended over fructose which may cause stomach discomfort
- 600-1200ml of a sports drink containing between 4-8% carbohydrate will meet a level of 30-60g per hour and can be sipped easily during exercise

Obviously, the type and timing depends greatly on the event. A marathon runner will have a consistent level of effort throughout a couple of hours and the carbohydrate needs to be in the form of liquid or gel for ease of digestion. A jumper or thrower may be out in the field for a couple of hours, but as their efforts are explosive and not sustained in the same way as an endurance runner, they have more options for refuelling during competition.

## AFTER TRAINING AND COMPETITION

Perhaps the most important part of an athlete's nutritional strategy is their refuelling and recovery phase. Without effective refuelling, an athlete will struggle to train regularly, in some cases two or three times a day.

Carbohydrate is key to this recovery. However, so is timing as the highest rates of muscle glycogen storage occur in the first hours after exercise. When an athlete only has a matter of hours between training, carbohydrate intake should begin as soon as is possible. Some endurance athletes may have up to three training sessions a day including a morning run, a strength and conditioning session early afternoon, followed by an additional running session late afternoon/early evening. Therefore, the need to refuel is essential, yet it is doubtful they would be able to consume the carbohydrates needed comfortably all from large meals. Therefore, a combination of small high-carbohydrate snacks, both drinks and solids, may be the best option.

In the immediate aftermath of a session, eating carbohydrates will start the muscle recovery process. This is also a key period in that the muscles are far more efficient in their storage of glycogen at this time. In essence, the immediate 2 hours post-session is the best window of opportunity for refuelling – both aiding recovery and preparing the body for the next session to come.

The table below demonstrates an athlete's immediate carbohydrate requirement in the initial hours after exercise:

Although the initial hours following a session are important, it is most important to ensure carbohydrate is being consumed. Glycogen storage will only happen when carbohydrate is eaten!

For athletes with regimes containing longer recovery phases between sessions, e.g. daily sessions; then the timing is less critical as long as the overall balance is correct with the correct amount of carbohydrate being met during the course of the day. It also means as an athlete, you have slightly more options over how to consume carbohydrates, e.g. as part of larger meals or in snack and liquid form.

Table 5 - Immediate carbohydrate needs after exercise

| Body weight (kg) | Carbohydrate needs (g/hr) |
|---|---|
| 40 | 40-48 |
| 50 | 50-60 |
| 60 | 60-72 |
| 70 | 70-84 |
| 80 | 80-96 |
| 90 | 90-108 |
| 100 | 100-120 |
| 110 | 110-132 |
| 120 | 120-144 |
| 130 | 130-156 |

## RECOVERY – OTHER NUTRIENTS TO CONSIDER

### Fluids and salt

In chapter five, the replacement of liquids is discussed in more detail. However water and salts lost through sweating need replacing: fluid at the rate of 1.2-1.5 litres per kg of bodyweight lost and salt through sport drinks and food.

### Protein

As you will find in the next chapter, protein is also essential to the recovery process, but generally when protein is added to carbohydrate immediately after training, glycogen storage is enhanced. In practical terms, this can help when food availability and energy intake levels make eating enough carbohydrate difficult. Protein in a post training snack can certainly enhance overall glycogen recovery and also influence the repairing and building of muscle tissue.

### Fat

The body's fat stores are relatively large, even in very lean athletes. Therefore, it is not necessary to purposely have a strategy for replacing fat post exercise. Although fat cells are metabolised in exercise, it is advisable to concentrate on carbohydrate intake in the initial hours of recovery – relying on regular meals to provide dietary fat.

Warning: excessive intake of protein, fat and alcohol is discouraged during the recovery phase as it could interfere with the practicality and process of effective glycogen storage.

### The dreaded wall

Hitting the wall; bonking out; running on empty... all expressions of the extreme symptoms of fatigue experienced by elite athletes who suffer a severe drop in energy – which primarily happens towards the end of an event.

As an athlete, you may have experienced those horrible few minutes when your become sluggish, unable to react quickly, your coordination and balance are compromised and you appear very dizzy.

The main cause is due to running out of glycogen in the muscles – although dehydration can also cause fatigue.

Therefore, to avoid hitting the wall, and to enable yourself to train longer and harder means ensuring your pre and during competition fuelling strategy provides you with a full tank of fuel (glucose) and making sure your recovery from a session or competition is not neglected.


adidas

# 004

A QUESTION OF PROTEIN

Protein plays an important role in the response to training and competing in athletics and is needed for building new tissue – including muscle – and repairing the old.

In this chapter you will find out:

- Protein is needed for both repairing and building muscle
- You do not need to eat extra protein or take special supplements if your diet meets your energy requirements and is varied
- Vegetarians and vegans can meet protein needs by selecting an appropriate diet
- The type and the timing of eating protein can be important

# 004
## A QUESTION OF PROTEIN

It doesn't necessarily mean that strenuous training, be it power based, sprint or endurance work, merits the need for extra protein. Most athletes will find that their protein intakes are high enough because of the additional food they require for energy in their event.

With athletics consisting of a huge array of differing sports, and the varying body types for different disciplines, it is always difficult to generalise. A good starting point is to look at the recommended levels of protein intake in relation to a person's daily activities.

### GENERAL PROTEIN RECOMMENDATIONS

It has been suggested that athletes undertaking an endurance or resistance training phase may need to increase their dietary protein intake above that of a healthy non-athlete.

Table 6 shows daily protein recommendations – expressed in grams per day for every kilogram you weigh: (g/kg/d)

Table 7 demonstrates how these recommendations suggest a wide range of daily protein needs for people of the same body weight, based upon their levels of activity and the athletics event they are training for.

However, it is difficult to divide athletics into strength, power and speed or endurance categories. Longer sprints will require speed-endurance, horizontal jumps will require sprint and power. Throws will require a combination of power and speed. Therefore it is far more advisable to examine your protein requirements taking into account the many other factors, e.g:

- specific event
- ability and level of training
- training goals
- competitive aims
- other nutritional requirements
- body weight and shape considerations

It is important to note that some diets are modelled around a high protein intake. Whilst you can adapt to this, athletes should be aware that it is not necessary for performance and offers no advantage.

Table 6 - Daily protein recommendations

| Activity level | Protein (g/kg/d) | Example |
|---|---|---|
| Low levels activity (non sporting) | 0.75 | A 60kg person needs 45g (60 x 0.75) of protein per day |
| Regular activity (more than 1 hour per day) | 1.0-1.2 | 60-72g of protein a day for a person weighing 60kg |
| Middle distance/ endurance athletes | 1.2-1.4 | 72-84g of protein a day for a person weighing 60kg |
| Strength/power/ speed athletes | 1.2-1.7 | 72-102g of protein a day for a person weighing 60kg |

Table 7 - Range of daily protein needs (g/d)

| Athlete's weight in kg | Activity level: endurance | Strength/power/speed |
|---|---|---|
| 40 | 48-56 | 48-68 |
| 50 | 60-70 | 60-85 |
| 60 | 72-84 | 72-102 |
| 70 | 84-98 | 84-119 |
| 80 | 96-112 | 96-136 |
| 90 | 108-126 | 108-153 |
| 100 | 120-140 | 120-170 |
| 110 | 132-154 | 132-187 |
| 120 | 144-168 | 144-204 |
| 130 | 156-182 | 156-221 |

# 004
A QUESTION OF PROTEIN

## DO YOU NEED MORE PROTEIN?

The issue as to whether or not strenuous physical training requires extra protein is more a scientific debate than a practical one. There are pros and cons on both sides of the argument. There is also evidence to suggest that exercise may decrease protein needs as the body becomes more efficient at using the protein it does have.

### Points to remember

- If you meet your body's requirement for energy, you can retain a lean body mass within a wide range of protein intakes. (However, different requirements may be needed if trying to build muscle mass)
- Research shows most athletes already eat more than 1.2-1.7g/kg/d (the highest suggested range) even without using supplements
- As energy requirements are increased and met by the diet, if the diet is varied and balanced – protein needs will be met also without having to adjust the foods or composition of the diet
- Inversely if the diet is severely restricted, either in energy intake or dietary variety, then there is a risk that protein needs – and those of other essential nutrients – may not be met
- Regardless of event or muscle size, it is thought there is no advantage in taking more than 2g of protein per kg of body weight per day (providing carbohydrate needs are met)
- Excess protein is metabolized and excreted, rather than converted into muscle
- High protein diets are not necessarily harmful, but can be expensive
- Concentrating on protein can lead to you neglecting other nutritional goals, e.g. low fat and adequate refuelling through carbohydrate

## PROTEIN IN FOOD

As previously discussed, if an athlete consumes sufficient food to meet both energy and carbohydrate requirements, then by default it is likely they are consuming an adequate amount of protein, particularly if the diet is varied.

The table below lists some everyday protein-rich foods.

Table 8 - Protein-rich foods

| 10g protein is provided by: |
|---|
| 30g lean meat or poultry |
| 40g fish |
| 70g soya beans |
| 125g tofu, lentils, kidney beans |
| Small tin (225g) baked beans |
| 50g nuts or seeds |
| 2 small eggs |
| 330ml cow's milk |
| 400ml soya milk |
| 30g skimmed milk powder |
| 200g yoghurt |
| 40g hard cheese (e.g. cheddar) |
| 110g breakfast cereal |
| 3 slices of bread |

### The meat of the matter

Animal sources are richer in protein than vegetable sources and, therefore, a larger quantity of non-animal sources are needed to provide the equivalent amounts of protein. Vegetarian strength and endurance athletes may struggle if they are unable to consume the bulky fibre-rich vegetables and pulses needed to meet daily protein needs. Therefore, it may be necessary to supplement the diet with a rich source of protein such as milk powder.

Factsheet 4 give three examples of athletes with varying protein needs based on their body weights and differing activity levels. Similar foods have been used throughout the three examples to illustrate differences in foods and quantities.

## PROTEIN IN MUSCLE RECOVERY

As we have discussed, dietary protein intake is needed for the recovery process following a training session, particularly in relation to the muscles. Research shows that the recovery process for muscle is enhanced when protein is eaten alongside carbohydrate. It is thought however, that the 'window of opportunity' is wider for protein recovery than for restocking glycogen (carbohydrate stores), so protein intake is needed after training but not quite as immediately.

### Strength and resistance training

It may be beneficial to consume small amounts of protein – around 6g – prior to training. It is thought to be more beneficial to consume proteins that are richer in essential amino acids than non-essential amino acids, e.g. meat, fish, eggs and dairy products. See chapter one – Down to Basics for a more comprehensive list.

### In summary

Despite a lack of extensive research in this area, the important thing to note is: after a heavy training session, consume a little protein (10-20g) in the post-training snack (see table 8 – most solid foods as well as milk and milkshakes, contain some protein).

In training for your event, your body relies mainly on muscle glycogen, liver glycogen and fat stores for fuel. Protein is used as muscle fuel if glycogen stores are low. Therefore, by keeping glycogen (carbohydrate) stores well topped up, you can stop muscle protein being used as fuel. Do this by making your diet rich in carbohydrate, and where necessary eat additional carbohydrate before, during and after exercise.

### One final thought on... Protein and Amino Acid Supplements

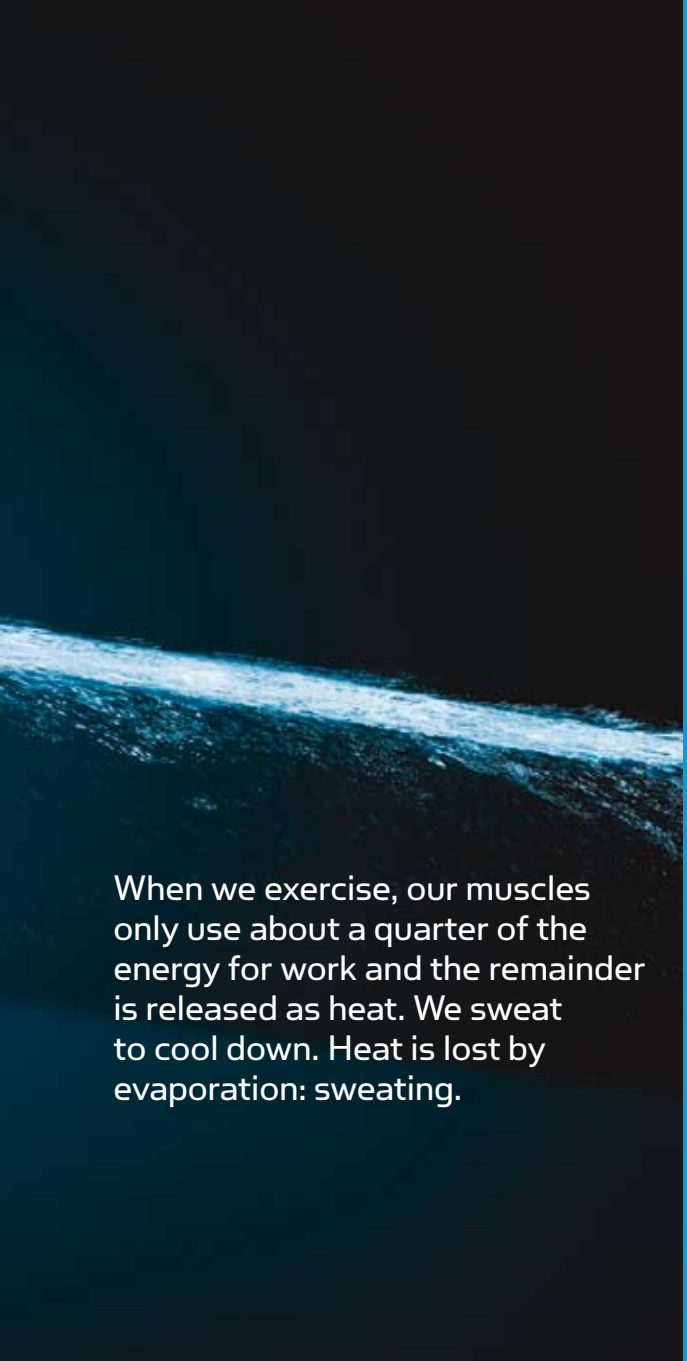
As has been discussed in this chapter – an athlete can easily meet their protein needs from everyday foods. This is true even when fat intake needs to be controlled. When a period of strict restriction of dietary fat is required, it is better to select appropriate protein foods – and look at altering cooking methods – before resorting to using any type of protein supplements. If you need advice in this area, we strongly recommended that advice is sought from a sports nutrition professional.

The mistaken belief is that high protein diets will lead to greater muscle mass and strength, because muscle itself is protein has led many sports people to invest in overly expensive supplement products. Nor is there any benefit in taking expensive amino acid supplements.

- Remember: excess protein is metabolized and excreted, rather than converted into muscle, regardless of whether it is obtained from food or a supplement!

# 005

LIQUID ASSETS



When we exercise, our muscles only use about a quarter of the energy for work and the remainder is released as heat. We sweat to cool down. Heat is lost by evaporation: sweating.

In this chapter you will find out:

- How drinking strategies are essential to performance and should not be neglected
- How to calculate your fluid losses from training and adjust your fluid intake to maintain performance
- The importance of sports drinks to replace both carbohydrates and fluid
- The importance of avoiding over hydration (hyponatraemia)

# 005
LIQUID ASSETS

Sweat comes from water in the body, which needs to be replaced to prevent dehydration. Exercising whilst dehydrated can cause your temperature to rise quickly and cause heatstroke, which is potentially fatal.

Replacing fluid lost during training or competition is crucial and becomes even more important in hot and humid conditions. If the fluid shortfall is too great then it is likely that this will have a detrimental effect on performance. In order to restore fluids after exercise, it is necessary to drink more than the amount lost through sweat as well as ensuring you replace the salts, particularly sodium, that are also lost in sweat.

Another factor to consider is when there is only a short time between training sessions, particularly if your training requires 2/3 sessions a day. In essence your post-exercise recovery is also your pre-exercise preparation. Having already discussed the importance of recovering sufficiently so that you're ready to train again through replacing your carbohydrates, it is as essential to tailor your fluid requirements to suit the specific challenges of your specific event, paying particular attention to the environmental conditions and the nature of your competition.

## FLUID REQUIREMENTS

Generally we need about 2-3 litres of fluid a day to be properly hydrated – about half of this normally comes from food and half from drinks. However, as an athlete, it is likely that your fluid needs will be higher due to the level of training you are doing.

The more you sweat, the more you need to drink to replace the lost fluid. Even small sweat losses can cause fatigue, especially in hot weather. Plus, the fitter you are, the more effective you are at keeping your body cool through sweating! Training harder, longer, in hot and humid surroundings will also make you sweat more.

It seems obvious to recommend that you aim to replace what you lose through training and competition – but that is easier said than done. Most people will only replace about half of what they've lost unless they make a concerted effort to measure their fluid losses and assess their rehydration in that manner. To estimate how much fluid you lose, weigh yourself before and after at least one hour of exercise under conditions similar to competition or hard training. It's preferable to weigh yourself without clothes, or at least in minimal clothing, so as not to include the sweat absorbed within your clothing. It is important to remember the following points:

- wear the minimum of clothes
- remove excess sweat from the body with a towel
- remove trainers and socks
- make sure you've passed urine prior to weighing before exercise
- weigh yourself as soon as is practical after exercise (within 10 minutes) and before passing urine
- record the amount of fluid you drink during the training session
- remember, the aim is to limit fluid losses – not to lose too much or to gain weight

As a guideline, each kg of weight loss is equivalent to one litre of fluid loss, but the amount of fluid needed is estimated to be 1.2-1.5 times the fluid lost – so that's 1.2-1.5 litres of fluid for every kg of weight lost during your session or competition.

The table below shows examples of calculating fluid loss, and how much is required to replace those losses for recovery.

To work out sweat rate per hr

- Weigh yourself before and after an hour of normal training during which you don't take on fluids (if you do this, ensure that the environment is temperate and you do not make yourself ill)
- The body weight lost = your sweat loss per hour, e.g. a 1kg body weight loss is 1000ml per hour or 500ml in half an hour

Table 9 - Examples of calculating fluid loss

| | | | |
|---|---|---|---|
| Initial weight: | a | 70kg | 72kg |
| Final weight: | b | 69kg | 72.5kg |
| Weight difference: | c = a-b | 1kg lost (1000ml lost) | 0.5kg gain (500ml gained) |
| Fluid drunk during session: | d | 500ml | 1500ml |
| Total fluid loss: | Y = c+d | 1000+500 = 1500ml | 1500-500 = 1000ml |
| Total fluid needed: | Z = Y x (1.2 or 1.5) | 1800 to 2250ml | 1200 to 1500ml |
| Extra fluid needed during recovery | Z-d | 1300 to 1750ml | None |

# 005
LIQUID ASSETS

If it's not possible to weigh yourself before and after exercise, look at the colour of your urine. If it's pale and plentiful, you're well hydrated, but if it's dark and sparse, you probably need more fluid.

If weight loss is unavoidable then try to limit dehydration levels to no more than about 2% loss of body weight. This is when it is thought it can start to be detrimental to performance. That's equivalent to 1kg for a person weighing 50kg, 1.5kg for a 75kg person and 2kg for someone who weighs 100kg. Beware, tolerable losses are smaller in hot and humid conditions and during endurance events. Conversely, it's also important to avoid overcompensating for sweat losses by drinking so much that you actually gain weight during exercise as this can also cause problems.

Unless your fluid loss and replacement is controlled, long training sessions in hot environments will lead to you becoming increasingly dehydrated. The result is not only a negative effect on performance, but a rise in body temperature, dizziness, nausea, fatigue and eventually heatstroke.

Prevention is better than cure – start off well hydrated and stay that way!

## DRINKING SCHEDULE

In terms of fluid and rehydrating, how much and what is essential – but you should also consider "when" as an important factor. Not only must you get the amounts right, but you also have to make sure your body is used to the strategy you adopt to counter dehydration, so it can adapt to the necessary fluid intakes required for your level of training and competition. Knowing how fast you can drink something is as important, and like a new pair of spikes, you should never attempt to try it out during an important competition. Work out your likely fluid needs in training and never in competition.

Don't leave things to chance. Take your beverage choice with you, and keep it with you while you work out or compete, and stick to your plan of when, what and how much.

Factsheet 5 provides a summary of how to approach hydration before, during and after exercise.
It's important to bear in mind that these are simply recommendations from what the science has discovered. Tailoring them to suit your individual needs and preferences is down to you.

In summary:

- after exercise, you also need to replace salt losses
- one of the main factors influencing fluid needs during and after exercise is the volume of fluid lost
- the length and type of exercise and likely sweat rates will determine volume of fluid needed
- although most athletes don't drink enough after a session, be aware you should not drink so much that you gain weight
- drinking too much plain water could cause a problem. If you're sweating very heavily for a prolonged period of time and could result in hyponatraemia – low blood sodium levels

## HYPONATRAEMIA

Excessive drinking can cause hyponatraemia. In milder forms, it can cause bloating and nausea – in serious cases it can lead to headaches, confusion, difficulty in breathing, loss of coordination, unusual fatigue and even death.

It is caused by drinking extreme amounts, firstly because urine production is decreased during exercise, limiting the body's ability to excrete excess fluids. Secondly, sodium is also lost in sweat, making it easier for the body's sodium levels to become diluted.

Women doing marathon running or long cycle rides can be at particular risk, as they are drinking and working out for a

prolonged period. As women are in general smaller than men, their body fluids get diluted quicker, and they sweat less and so don't need to drink as much in the first place.

Whilst dehydration should be the main concern for you as an athlete, hyponatraemia is a possible threat to athletes who go too far with their drinking practices. Therefore, during long periods of training or in competitions, e.g. in marathons, a sports drink containing sodium can be useful in helping replace the salts lost in sweat.

## BEVERAGE CHOICE

The type of drink you opt for is also important. The choices can be determined by the event you compete in, the length of effort and the type of conditions you are training or competing in.

Yet, ultimately, it's important to ensure something as simple as it being a flavour or consistency you like – as this will encourage you to drink more. Conversely, a drink with all the correct composition will not do you much good if the taste of it dissuades you from drinking it. If training at a low-to-moderate intensity for less than an hour, then water will suffice – if necessary add juice or squash, which will also provide you with some carbohydrates to help restock glycogen (carbohydrate) stores.

Factsheet 6 provides a summary of the different types of drinks available for different situations.

### Beverage choice during exercise

During a session or competition that lasts for longer than an hour and causes fatigue, the recommendation is to ingest 30-60g per hour of rapidly absorbed carbohydrate, because it generally improves performance. In this instance, a sports drink would be useful.

Sports drinks provide both carbohydrate and fluid simultaneously to help prevent fatigue. Most commercial sports drinks are 4-8% carbohydrate (i.e. they have 4-8g of carbohydrate per 100ml of fluid), making them 'isotonic' – a similar concentration to blood – and, therefore, are quickly absorbed. The carbohydrate can come from sugars (glucose, sucrose, and syrups which contain no more than about 50% fructose), maltodextrins or other rapidly absorbed carbohydrates.

Sports drinks also contain sodium to stimulate sugar and water absorption, and replace the sodium lost in sweat. This is useful for those who train for longer than 2 hours or for athletes that experience heavy sodium losses – i.e. more than 3-4 g of sodium.

Caffeine contained in commonly available beverages can enhance power output during the later stages of endurance performance. This benefit can be obtained with relatively small doses of caffeine – about 1.5mg per kg body weight or approximately 50-100mg – from commonly consumed drinks such as coffee and cola beverages.


# 005
LIQUID ASSETS

### A question of salt?

It is difficult to estimate how much sodium you are losing. But as a general rule, if you:

- have opaque sweat
- if your sweat tastes salty
- if it leaves white marks on your clothes

...then you should probably consider having some extra salt.

Sodium has the benefit of encouraging you to drink more. In fact, the drive to drink is present for several hours after training or competing. Beware – when your mouth is moistened with fluid, your body automatically signals your brain to stop drinking. This often happens before your body's fluid levels have been completely restored – hence the reason why thirst is not a good indicator of whether or not you are hydrated.

### Beverage choice after exercise

As highlighted earlier, restoring hydration levels can only be achieved through drinking 1.2-1.5 times greater than the amount lost through sweat. And as acknowledged – it's important that you like the taste otherwise you won't drink enough! However, it is also important that the sodium lost in sweat is also replaced.

Therefore the success of a rehydration drink depends, amongst other factors, on palatability and sodium concentration.

Although daily sweat and sodium losses vary widely among individual athletes and depends on many factors – such as diet, physical condition, environment and heat acclimatisation – it is assumed that where sweat losses are high, sodium losses will generally also be high.

Therefore, a moderate excess intake of salt would appear to be beneficial for rehydration and without any detrimental effect on health, providing that fluid intakes are also in excess and kidney function is not impaired.

Therefore if only liquids are available following exercise, it is best to opt for sports drinks that contain sodium. Plain water can be drunk if a source of sodium is available at the same time from (or added to) food. Although other salts are lost in sweat – potassium and magnesium in particular – including these as part of the recovery strategy seems to have no particular benefit over and above sodium.


### Cheers

Although alcohol in moderation is fine, it's certainly not a good idea to drink it just before or immediately after exercise. You need to ensure you have rehydrated properly before drinking alcohol following a competition no matter how much you want to celebrate or commiserate.

Alcohol before exercise not only has a detrimental effect on co-ordination skills and exercise performance, but also increases the risk of injury. Furthermore, alcohol can cause dehydration and slow down recovery from injury. See chapter one - Down to Basics for more information on alcohol.

Only a healthy, balanced diet can provide the nutrients required by the body. As no single food can provide all the essential nutrients, variety is essential to meet our nutritional needs with vitamins, minerals and antioxidants. So the question is: are vitamins and minerals really that important?

In this chapter you will find out:

- A wide range of vitamins and minerals are necessary for good health
- An athlete requires a wide variety of foods to help ensure the quota of micronutrients are met, but generally do not need extra vitamins and minerals
- Excessive intake of some micronutrients can be harmful
- Micronutrient supplementation does not enhance performance – unless it is being taken to correct a pre-existing deficiency

# 006
A LITTLE EXTRA HELP

It is generally accepted that an adequate supply of a wide range of vitamins, minerals and trace elements is necessary for good health, and that our dietary intake needs to meet our body's requirement for all these micronutrients.

However, it should be noted that exercise does not particularly increase the need for vitamins and minerals. Providing you are eating a healthy, balanced diet, that meets your energy needs as well as including a wide variety of foods, you should have no problem getting all the vitamins and minerals you need.

As an athlete, if you are training and competing and not restricting your energy intake, then you will need to eat more food to meet the increased energy demand of your training. Providing it's a varied mixture, you will also be getting more vitamins and minerals. Although strenuous and prolonged exercise stresses the body, the right diet will help ensure good health is maintained. Therefore, even elite athletes do not usually need extra vitamins and minerals.

## VITAMINS

Vitamins are a unique and diverse collection of chemicals. The amounts we require them in are very small quantities – usually only a few micrograms (µg) or milligrams (mg) per day – but are essential for many processes carried out in the body. However, as we are unable to create most vitamins, they need to be supplied in adequate amounts by the diet to prevent any deficiencies.

Vitamins are generally classified in relation to their solubility in fat or water. The

| | Fat-soluble vitamins A, D, E and K | Water-soluble vitamins B group and C |
|---|---|---|
| Risk of deficiency | Very low fat diets and conditions where fat absorption is impaired | Diets lacking in variety |
| Stability in foods | Robust to heat and light | Varies, often unstable when exposed to heat and light |
| Storage in body | Can be large and long-term | Often small, so frequent regular intakes required |
| Risk of toxicity | High | Low, as high intakes are usually excreted in urine |

Table 10 - Characteristics of vitamin groups

fat-soluble vitamins are A, D, E and K and the water-soluble vitamins are the B group of vitamins and vitamin C. This classification gives us an indication of food sources, function and distribution in the body, and potential toxicity. Table 10 above outlines some vitamins and their characteristics.

## MINERALS

Minerals and trace elements are, like vitamins, only required by the body in very small quantities, but nonetheless remain essential for normal body function. Those required in milligram (mg) quantities (sometimes several hundred milligrams) tend to be referred to as minerals and those required in smaller amounts (micrograms (µg) quantities) are usually called trace elements. Table 11 lists some minerals and trace elements essential for humans.

| Minerals | Trace elements |
|---|---|
| Calcium | Copper |
| Phosphorus | Chromium |
| Magnesium | Manganese |
| Sodium | Molybdenum |
| Potassium | Selenium |
| Iron | Iodine |
| Zinc | |

Table 11 - Essential minerals and trace elements



# 006
A LITTLE EXTRA HELP

## ANTIOXIDANTS

Athletics training and competing can result in an increased production of radicals (oxidants) and other forms of reactive oxygen species in the working muscles. Therefore, when the muscle contracts there can be oxidative damage, which in turn could result in muscle fatigue or injury.

Muscle cells utilize a network of antioxidants to protect themselves against the risk of oxidative stress and damage. There is some evidence for an adaptive increase in antioxidant status in response to regular exercise, and so this may help protect against further damage.

Common dietary antioxidants are glutathione, vitamin E, vitamin C, lipoic acid, carotenoids, uric acid, bilirubin and ubiquinone. Several minerals also play important, but indirect roles in providing antioxidant protection in the cells. The minerals and trace elements involved in antioxidant related functions include iron, zinc, copper, manganese and selenium. However, not all antioxidants are created equal and so they may often benefit from working as a network.

### In summary

- There is limited evidence that supplementary dietary antioxidants could improve exercise performance
- It is also not known whether high training levels require antioxidants beyond what you would get from a balanced diet with plenty of fruit and vegetables
- Therefore dietary supplementation is not recommended to athletes at this time
- It is more advisable to adapt the diet to include dietary sources of antioxidants than experiment with supplements
- "mega-dosing" may actually impair muscular performance – too much of a good thing is not necessarily a good thing!

### Exceptions are

Supplementation with dietary antioxidants may be justified if there is an increase in training stress. Increased training levels, training at altitude, exercising in polluted areas or in a hot environment. All micronutrients – vitamins, minerals and antioxidants – are best sourced from a varied and wholesome nutrient-rich diet high in carbohydrates and based on vegetables, fruit, beans, legumes and grains, as well as meats and oils.

Factsheet 7 lists nutrient-rich food sources for the key micronutrients.

## HOW MANY FRUIT AND VEG?

It is recommended that we eat at least five portions of fruit and vegetables per day, as they are nutrient-packed and a good source of antioxidants and soluble fibre. Regardless of whether they are fresh, frozen, canned, dried, or juiced (although fruit juice can only count as one portion a day), variety is the key.

In the UK most of us are only managing three portions a day – some individuals don't even manage that. It is essential we try to reach these targets, and even more so if you are an athlete.

One of the suggestions is that people do not know what constitutes a "portion". Table 12 shows how the size of the fruit/vegetable determines a portion.

## MICRONUTRIENT DEFICIENCIES

Athletes who are undergoing regular strenuous training will need to be eating a high energy diet, and providing it is reasonably varied, will provide micronutrients (vitamins and minerals) in excess of the recommended intake levels for general health. Therefore, the recommendation is that there is no need for you, as an athlete, to take vitamin and mineral supplements.

Unless needed to correct a pre-existing deficiency, supplementation with vitamins and minerals is not proven to

| What is a portion of fruit and vegetables? | |
|---|---|
| | 1 large slice of a very large fruit, e.g. melon, pineapple |
| or | 1 whole medium fruit, e.g. apple, pear, orange |
| or | 2 small fruits, e.g. plums, satsumas, kiwi fruit |
| or | 1 cupful of a very small fruit, e.g. grapes and berries |
| or | 2-3 tablespoons of fruit salad – fresh, stewed or canned |
| or | 1 tablespoon of dried fruit |
| or | 1 glass (150ml) of fruit or vegetable juice |
| or | 2 tablespoons of vegetables – fresh, frozen or canned |
| or | 1 dessert bowl of salad |

Table 12 - Portion of fruit and vegetables

enhance exercise performance. Yet even a small deficiency, with only a minor impact on body function, may impair exercise performance. Whilst in theory, it is possible to be deficient in any micronutrient, it is generally uncommon with the exception of calcium and iron. It should also be noted that in the case of vitamins, minerals and antioxidants – more does not mean better. Excess intakes of certain micronutrients, particularly the fat-soluble vitamins (A, D, E and K) and iron, can be toxic. Fat-soluble vitamins can accumulate in the body tissues, so if recommended amounts are exceeded over a long period then they may reach toxic levels. The water-soluble vitamins (the B group and C) are simply passed out in the urine if consumed in excess of requirements.

Other deficiency risks:
Athletes on restricted diets may put themselves at risk of inadequate micronutrient intakes. The following lists common dietary situations where there is a higher risk of nutrient deficiencies.

- Diets low in energy for weight loss – especially if followed for a long period
- Diets which omit foods or food groups – likes/dislikes – vegetarians and vegans
- Diets lacking in a particular type of food – allergy or intolerance
- Diets that are erratic and unbalanced – restricted food intake – disordered eating

Athletes should always consult with a sports nutrition professional before considering supplements. If food intake cannot be sufficiently improved, e.g. travelling to foreign countries where there is a limited supply of 'safe' food, then a low-dose multi-vitamin and multi-mineral supplement may be necessary. However, single, targeted, nutrient supplements should only be taken under medical supervision for an established nutrient deficiency.

Strict vegetarian diets, although high in carbohydrate and therefore great for providing energy fuel, could potentially lead to micronutrient deficiencies in iron, calcium, iodine, zinc and vitamin B12. Therefore, a vegetarian athlete should seek nutritional advice from a sports nutrition professional, as to whether supplementation is necessary.

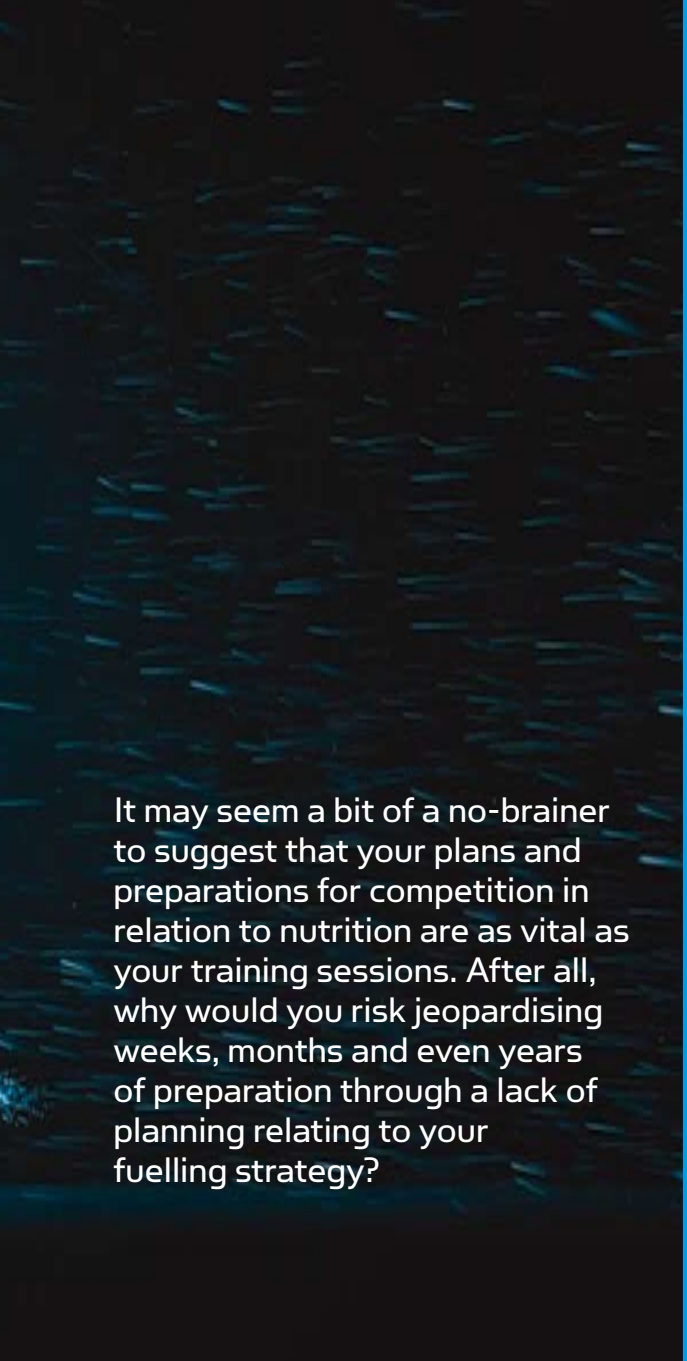
Some athletes, e.g. menstruating females, vegetarians and endurance runners may have a greater tendency to develop an iron deficiency – however it is not advisable to routinely take iron supplements.

Unexplained fatigue and a fall in performance needs to be fully investigated by a medical professional such as a sports medicine doctor and/or a sports dietitian. Untreated, low iron stores can progressively lead to problematic iron deficiency. Athletes at a high risk of iron deficiency should routinely undergo assessments of their iron levels.

It is always better to adapt the diet than resort to taking a supplement. Taking a supplement does not make a bad diet better. For more information relating to the considerations for a vegetarian athlete, see the Question and Answer section in chapter nine.

# 007

PERFORMING WHEN
IT COUNTS



It may seem a bit of a no-brainer to suggest that your plans and preparations for competition in relation to nutrition are as vital as your training sessions. After all, why would you risk jeopardising weeks, months and even years of preparation through a lack of planning relating to your fuelling strategy?

In this chapter you will find out:

- That carbohydrate, water and salt levels need to be optimised before competition in order to get the best out of yourself
- How 'carbo-loading' can be beneficial to events that last more than 90 minutes
- The importance of planning, refuelling and hydrating strategies, so they are right for competition
- Making sure your pre-competition food has enough carbohydrate and how to recover in order to sustain performance

# 007
PERFORMING WHEN IT COUNTS

Unfortunately, with so much emphasis on training for your event, sometimes other considerations are not made until the last minute. As an athlete on the world class plan, this process needs to be as natural to you as your training schedule. After all, you need to ensure you get your diet right before, during and in the recovery from the event. And if, as is the case in some events, you have more than one round a day, it's even more important that you recover properly before competing again.

## FUELLING UP FOR COMPETITION

In the immediate few days before competition, you may be tapering down training levels. During this time, it is important to eat correctly and match your requirements to that of a more moderate training regime. However, it is still important to focus on carbohydrate as the main source, to ensure that energy stores are stocked-up for the competition.

In the first instance, you must make sure you restock your glycogen stores from training – particularly if your event lasts longer than an hour. Otherwise you are already at a disadvantage against your opponents.

If you are competing for less than 90 minutes, you can stock up by resting for about a day beforehand and consuming carbohydrate – about 7-10g per kg body weight. All athletes would do well to realise that a day's rest or light training whilst eating a carb-rich diet, is sufficient to restore glycogen levels (see chapter three for more details relating to carbohydrates).

## CARBOHYDRATE LOADING

If your event continues for longer than 90 minutes, then you are likely to benefit from carbohydrate loading to maximise your glycogen fuel stores prior to the competition. This can be achieved by reducing training levels (both intensity and duration) and at the same time eating a large

amount of carbohydrate (around 8-10g carbohydrate per kg body weight per day) for 2-3 days before the event. Whilst an athlete may find they are gaining some weight following a carbohydrate loading phase – this is normal. You may also feel heavy in the early stages, but you will feel the benefit later.

Factsheet 8 show examples of foods over a day providing 8-10g carbohydrate per kg body weight to meet the carbohydrate loading diet needs of three individuals with different body weights. By using similar foods, you can see what happens to foods and quantities in different circumstances.

At present, it is mainly thought that carbohydrate loading is useful for endurance events such as marathons. However, with any change in diet, it is worth having a look at how increased carbohydrate intake affects your performance in training, to gauge if it suits your needs and requirements. The only certainty is that low carbohydrate stores will impair performance.

Other considerations you may wish to consider:

- carbohydrate loading has also been shown to increase exercise performance in the heat, so this is something worth experimenting with in training if an event is in a hot climate
- both male and female athletes will benefit from carbohydrate loading, providing both energy and carbohydrate intakes are also adequate
- if too many competitions close together make it difficult to carbo-load effectively, then try to fuel up as much as is practical and prioritise the most effective loading for the more important events or finals

# 007
PERFORMING WHEN IT COUNTS

## PRE-COMPETITION MEAL

As well as having a strategy for fuelling in the days approaching an event – what happens in the hours before can also be significant. If you eat a carbohydrate-rich meal about 3-4 hours before the event, it is thought it can enhance performance by helping to maintain blood glucose levels.

Pre-competition meals can also help to stock inadequate muscle glycogen stores and restore liver glycogen stores which get depleted during the night. Restoring liver glycogen stores is particularly essential for competitions that start in the morning.

It is important to be aware that for an athlete, the majority of events will take place in the evening – meaning you are used to preparing yourself for competition at a latter part of the day. Then when you come to compete at a major championships some athletes can be caught out by having to compete in the morning. The exception to this may be a marathon runner, for whom many of the key races will take place in the morning hours.

Although carbohydrate is especially key for endurance athletes, for the shorter events that do not cause fatigue or deplete carbohydrate stores, then there does not need to be such an emphasis on carbohydrate for the pre-competition meal.

For intense competitions that last longer than an hour, such as endurance races, plus for competitions where there are multiple events or rounds in one day, then it is recommended that athletes consume 1-4g carbohydrate per kg body weight during the six hour period before competing.

Factsheet 9 demonstrates examples of pre-competition foods that provide 1-4g carbohydrate per kg body weight for three individuals with different body weights. Similar foods have been used to illustrate what happens to foods and quantities in different circumstances.

### Other considerations

- Don't forget to experiment with different foods and amounts during training – you need to find foods which not only provide energy, but also reduce hunger, settle the stomach and are convenient and practical
- Choosing low GI carbohydrates for the pre-competition meal sometimes helps sustain the delivery of carbohydrate during exercise but does not necessarily improve performance, particularly when additional carbohydrate can be consumed during the event
- Carbohydrate does not need to be eaten in the hour or two before competition, providing carbo-loading has taken place in the 2-3 days before competition and the competition is not late in the day
- Early morning events can make it hard to decide what to do. It is hard to get up early enough to have a meal 3 or 4 hours prior to the event without reducing the sleep needed – you may prefer a lighter meal or snack and to continue to fuel whilst competing
- If you suffer from stomach problems: if you consume meals prior to an event, it is advisable to choose foods low in fat and low in fibre, as well as low to moderate protein. Liquid meal supplements/replacement meals or carbohydrate-containing drinks and bars are also easier to consume

## CARBOHYDRATES – IMMEDIATELY BEFORE AND DURING?

For some athletes, a carbohydrate snack 30-60 minutes before exercise can be beneficial, providing they don't have a sensitive stomach when eating before exercise.

The most important factor is to get the balance and amount right, e.g. if pre-exercise carbohydrate is needed, it is important to consume more than 70g, and best to opt for high GI carbohydrate. If 50g is consumed, the body expects carbohydrates to be made available for fuel, but the small amount does not provide enough to sustain the effort.

In fatiguing events that last longer than an hour then it is advisable to consume 30-60g per hour of rapidly absorbed carbohydrate, as this can improve performance. This intake is best achieved by taking feedings every 10-30 mins, event permitting – as this can help provide a steady flow of glucose into the bloodstream.

Remember: planning and practising is everything – only try new strategies in training. See chapter three for a list of pre-exercise snacks that provide at least 50g of carbohydrate.

## INCREASED FAT – BETTER BEFORE EXERCISE?

There is limited research concerning increasing fat availability in the diet for endurance performance.

The theory is that it will reduce the call on carbohydrate usage and delay the onset of carbohydrate depletion and fatigue. Increasing fat availability before an event – whether it is immediately before or a matter of an hour – can reduce carbohydrate usage, but it is not certain this will enhance exercise performance.

If an athlete finds that fat adaptation can be an effective strategy for enhancing their performance, then it is best to opt for brief exposure over a prolonged period of increased fat consumption. It should be thought of as a pre-competition tactic rather than a long-term nutritional strategy. However, it should be experimented with during training to discover whether it suits you and improves performance – the ultimate outcome.

## HYDRATING PRIOR TO COMPETITION

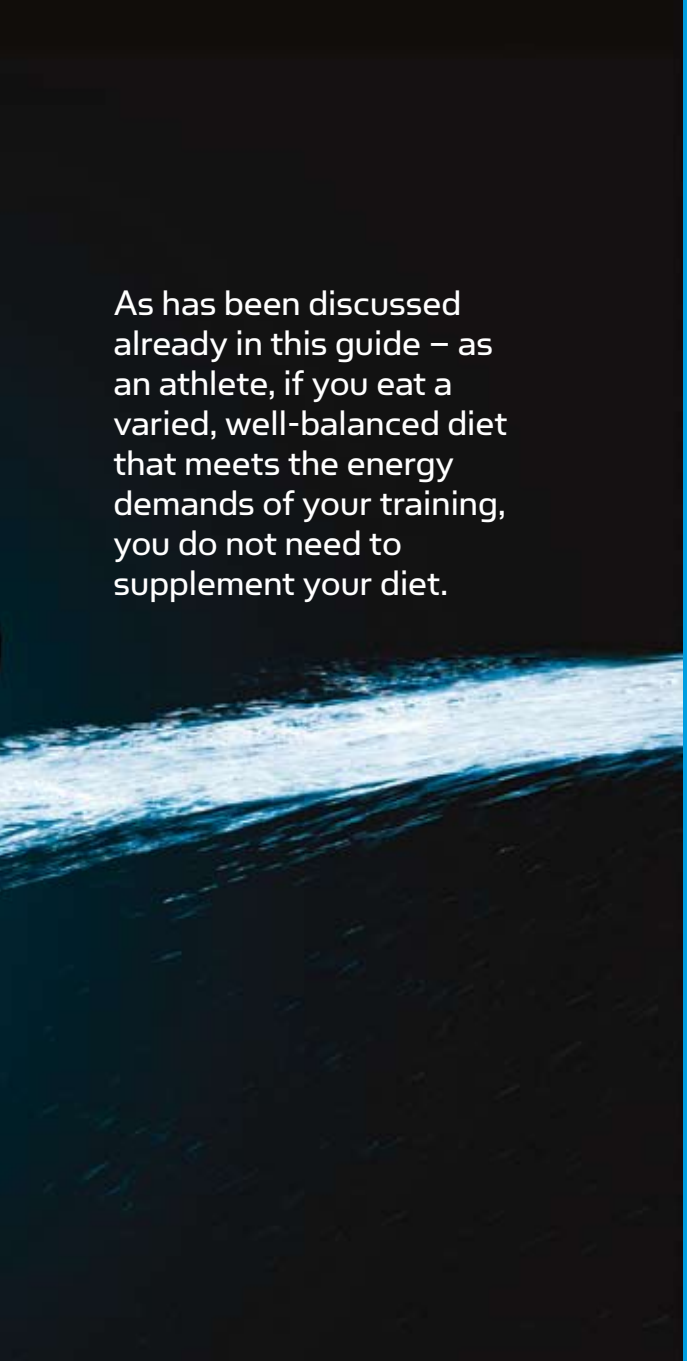
As stated in a previous chapter, since a degree of dehydration will occur during competition, good hydration is essential before competing. Therefore, pre-competition preparation should also consider hydration levels, to ensure fluid and salt losses from previous training or competition have been optimally replaced.

- Hydration strategies are an essential aspect of pre-competition planning and are discussed in more detail in chapter five. But the main points in summary are:

- athletes should drink sufficient fluid the day before competition to ensure that they are well hydrated
- different drinks strategies, including over-hydration etc. should be tested out during hard training sessions that mimic the competition effort
- before competition, drink around 400-600ml of fluid (with or without carbohydrate) in the 60-90 minute period before competing
- it may help to drink 300-500ml of fluid in the 10-15 minutes prior to strenuous events that last longer than an hour
- once again, it's fundamental that you plan and practise hydrating strategies that you intend to use. It is not advisable to try out new drinks or hydration strategies during important competitions!

## THE FINAL WORD

There is no point in adopting any of the strategies discussed in this chapter if you are not physically prepared following your training and last competition – therefore, recovery is the key. Recovery is part one of fuelling for your next session or competition. It should not be neglected or you will already be one step behind your opponents.



As has been discussed already in this guide – as an athlete, if you eat a varied, well-balanced diet that meets the energy demands of your training, you do not need to supplement your diet.

In this chapter you will find out:

- Many athletes choose to use supplements
- Supplements cannot make a bad diet better, and are often ineffective
- Some supplements can do more harm than good
- Use of supplements is not advised – due to health risks, contamination issues and potential doping risks

# 008
ADDED EXTRAS

Previous sections of this book have looked at the way diet can be optimised to support training levels that lead to enhanced exercise and competitive performance. Informed dietary choices can ensure fuel needs are met in order to effectively:

- adapt to training
- recover from training so that it is kept consistent and built upon
- maintain good health – preventing illness and injury

A varied, well-balanced diet with sufficient energy should provide adequate amounts of all the essential nutrients. However, in some situations, obtaining sufficient amounts from the diet is often not so straightforward. Consequently, some athletes take dietary supplements in the hope that it will compensate for poor food choices and make up for vital nutrients that they feel are lacking in their diet.

## SUPPLEMENT USAGE

- Surveys have shown that nearly half of all athletes use supplements
- There are of course differences between athletes of differing ages, performance levels, and cultural backgrounds
- In some events and disciplines, supplement usage is more common than others. But that does not mean it is right!
- Most athletes would benefit from improving their diet

The role of diet in supporting athletic performance is essential when training levels – intensity, duration and frequency – are high.

rather than resorting to taking an inappropriate supplement – as we have heard, taking a supplement does not make up for a bad diet!

Not only is supplement usage common, but all too often the recommended doses are exceeded. Sometimes it is simply an attempt to outdo what their opponent is taking. However, more does not necessarily mean better, and in the case of some supplements – such as the fat-soluble vitamins (A, D, E and K) and iron – more can be toxic, and so would actually be doing more harm than good.

The frequently quoted reasons for supplement use include:

- compensation for an inadequate diet
- to meet unusual demands of hard training or competition
- to produce specific benefits to exercise performance
- to keep up with team-mates or opponents
- recommended by coach, parent or other influential individuals

### 'Just in case' syndrome

Even when athletes are informed that their diet is sufficient or that the nutrient status of their body's stores is normal (for example iron stores) they still continue to take supplements as perhaps a form of insurance – 'just in case'.

## COMMON SUPPLEMENTS

There are a huge list of supplements and ergogenic aids used within sport. The list below shows the types of commonly used sports nutrition supplements:

- Sports drinks
- Carbohydrate bars and gels
- Protein powders, drinks and bars
- Liquid meal supplements
- Vitamin and mineral supplements
- Ergogenic aids

Athletes often use energy bars and sports drinks - and this is because they have a genuine role to play in supplementing the training diet. Sometimes common protein supplements and liquid meal replacements can come in useful in various situations. In the rare case of a deficiency of an essential nutrient, supplements can be beneficial, as long as this does not exceed the nutrient requirements.

Ergogenic aids (defined as any substance, food, chemical or training method that helps the body work harder and perform better) enhance performance through effects on energy, alertness or body composition.

Athletes often look for that specific supplement which can improve performance and help them in competition, but that is not against the rules. However, even if a supplement does all that, it could still be harmful in the short or long term.

For the purposes of this resource we will look at legal supplements where there is scientific evidence to suggest there may be potential benefits in certain events and competitive situations.

# 008
ADDED EXTRAS

## ENERGY

Several nutritional ergogenic aids help by influencing energy supply, e.g. carbohydrate supplements in the form of bars, powders, gels or sports drinks. Carbohydrates during prolonged exercise provide extra energy fuel to help prevent fatigue. Sports drinks deliver water and fuel to the body fast – so help to avoid dehydration and fatigue.

Other ergogenic aids have been shown to be beneficial for some athletes. Both creatine and bicarbonate/citrate supplements can be useful during high intensity work. However, as long term effects aren't yet known, as an athlete, you will need to work out whether it is worth the risk or the financial cost!

### Creatine

Back in chapter two – Energy, we learned about ATP and found that in the first few seconds of sprint exercise, creatine phosphate is used as a fuel. Therefore, creatine supplementation can help increase muscle creatine phosphate levels which could help athletes recover quickly between repeated bouts of high intensity exercise. However, creatine supplementation can also cause an increase in muscle mass which may not be beneficial for some athletes.

Vegetarians will get virtually no creatine from their diet, whereas a non-vegetarian diet provides about 1g of creatine a day. This needs to be something a strength and power vegetarian athlete is aware of.

Creatine supplementation may improve athletics performance. However, a steady maintenance dose of 2-3g per day for key periods of 6-10 weeks is advised, as opposed to experimenting with high loading doses. Care must be taken not to exceed the maximum effective dosage (20g per day if loading is required) as this could actually be harmful.

### Bicarbonate/Citrate

In many athletics events requiring high intensity effort for an extended period of time, e.g. 400m and 800m, the muscles produce lactic acid, which can be painful and interfere with performance. Working on the same principle as using antacids to neutralise indigestion and stomach acidity, sodium bicarbonate (baking soda) and sodium citrate can help neutralize the acidity of lactic acid in the muscles and thereby delay the onset of fatigue.
E.g. taking some sodium bicarbonate – around 0.3g per kg body weight, so that's about 24g for an 80kg athlete – over a period of 2-3 hours before exercise can improve performance in events lasting a few minutes. However, bicarbonate is generally only useful in short-term high-intensity events. Some athletes may suffer side effects such as vomiting and diarrhoea until a tolerance develops.

Other acid-neutralizing substances, such as sodium citrate, may be equally effective and generally produce fewer side-effects.

## CAFFEINE AND STIMULANTS

The list of substances prohibited in athletics includes stimulants. However, caffeine is unique in that it is a central nervous system (CNS) stimulant but is commonly consumed in a wide range of food and drinks. Caffeine also has a direct effect on muscles and adipose tissue (fat). In particular, it is believed to mobilise fatty acids from adipose tissue stores, increasing the availability of fat as a fuel during exercise, which

in turn helps spare the limited glycogen (carbohydrate) stores and extend exercise time. Caffeine contained in commonly available beverages can enhance power output during the later stages of prolonged endurance exercise and may also be helpful in short-term high-intensity exercise. This benefit can be obtained with relatively small doses of caffeine – about 1.5mg/kg body weight, so that's about 100mg for a 70kg athlete – from commonly consumed drinks such as coffee and cola beverages.

Some studies have found that caffeine is performance enhancing during exercise of varying duration and intensities – so that's most events within athletics - at low doses of less than 3mg/kg body weight. This suggests that its main effect is on the CNS – the implication is that low doses of caffeine could aid performance in both training and competition. The sensitivity to caffeine varies enormously between individuals, and in high doses it may have some side effects such as insomnia, headaches, abdominal problems, muscle shakes and impaired coordination. Therefore, as with any nutritional change, you should only experiment with caffeine during training, before using it during competition. Caffeine is also a mild diuretic so it is important to stay well hydrated, particularly if consuming caffeine in a tablet form, or during prolonged endurance exercise, or when exercising in a hot and humid environment.

Prior to January 2004, a caffeine level in the urine above 12mg/l was not permitted during competition and would result in a positive drug test. In general, this level was achieved by taking about 500mg caffeine – that's about 6 cups of strong coffee in a short time. Although caffeine is indeed a mildly addictive drug, it is acceptable and almost impossible to control its use – especially since it is not impossible to have a caffeine intake level that exceeds the permissible limit just from a normal diet.

The table below shows the caffeine content of some common drinks. The World Anti-Doping Agency (WADA) removed caffeine from the list of banned substances with effect from January 2004.



Table 13 - Caffeine content of common drinks

| Standard drink | Caffeine content (mg) |
|---|---|
| Instant coffee | 50-70 |
| Filter coffee | 60-120 |
| Tea | 15-50 |
| Hot chocolate | 8-15 |
| Cola | 20-50 |

# 008
ADDED EXTRAS


## BODY COMPOSITION

Body composition can certainly be a factor affecting performance. Therefore it is an area that some supplements claim to have an effect – either by increasing muscle mass and/or reducing body fat.

Supplements include:

- protein and amino acids
- carnitine
- chromium
- hydroxymethylbutyrate (HMB)
- boron
- chrysin
- colostrum
- creatine
- ornithine
- alphaketoglutarate
- tribulus terrestris
- vanadium
- zinc

However, most have been shown to be ineffective. (See chapter four – A question of protein for further information relating to protein and amino acid supplements.)

Additionally there is no evidence that taking prohormones such as androstenedione ('andro') and norandrostenedione result in a significant increase in blood testosterone, nor are they effective at increasing muscle size or strength.
Warning: Use of these supplements would result in positive drug test and may pose serious health risks.

## Immune function

Although modest exercise is good for the immune system, very strenuous and prolonged training has been linked with a depressed immune function. An inadequate diet on top of hard training will further lower immunity.

Deficiencies of energy, carbohydrate, protein and certain micronutrients including iron, zinc and vitamins A, E, B6 and B12, will impair immune function. Although athletes can easily avoid deficiencies by adapting their diet, you must take care not to exceed requirements of both dietary

fat, in particular omega-3 (Ð-3) fatty acids, and some micronutrients, especially iron, zinc and vitamin E, as this can also have a detrimental effect on immune function.

As an athlete, you will know how an illness that interrupts training or competition is pretty disastrous. So it is no surprise that some supplement manufacturers play on this fear and promote high doses of antioxidant vitamins, glutamine, zinc, probiotics and Echinacea as 'immune-boosting', despite there being no strong evidence that they work.

The best advice supports the need for a carbohydrate-rich diet, which lowers stress hormone levels, along with adequate rest periods. As discussed already in this resource, it may be beneficial to consume about 30-60g of carbohydrate per hour during prolonged exercise since this will help reduce some of the negative effects of prolonged exercise.

### Joint health

Supplements claiming to be good for joint health by protecting against wear and tear are:

- antioxidants
- fatty acids
- vitamins B3, B5 and D
- calcium
- boron
- proteolytic enzymes
- glucosamine
- chondroitin
- methylsulphonylmethane (MSM)
- S-Adenosyl methionine (SaME)
- type 2 collagen
- hyaluronic acid
- soy isoflavones

However, most have been shown to be ineffective.

Healthy bones need an adequate supply of calcium and vitamin D, but these are normally supplied from a healthy balanced diet and so supplementation is generally not necessary.

There is some evidence that regular (once or twice a day) long-term (about 2-6 months) treatment with glucosamine and chondroitin sulphate can provide subjective relief in individuals with osteoarthritis. However, there is currently no evidence that this would also be beneficial to athletes with joint pain.

### Contamination issues

It is worrying to note that impurities such as lead, broken glass and animal faeces have been found in some supplements and food products. Some supplements have been found not to contain the expensive ingredients listed on the label, but only inexpensive materials. But most worryingly for you as an athlete, is that some have been found to contain banned doping agents such as steroid hormones, for example nandrolone and testosterone that are not supposed to be there.

The IOC laboratory in Cologne found that at least 1 in 7, and possibly as high as 1 in 4, of the products they analysed contained steroid hormones and their precursors – these would cause an athlete to fail a drug test. Substantial numbers of positive tests were obtained from dietary supplements bought in the UK (19%), the Netherlands (26%) and the USA (19%).

There is currently an inadequate regulation of dietary supplements so athletes struggle to know what supplements actually contain or how pure the product and its ingredients are.

This is a serious problem – the principle of strict liability means that the onus is on the athlete to be sure – basically you are responsible for everything you eat and drink. Therefore all athletes should be extremely cautious about using supplements and always check with a sports doctor.

# 008
ADDED EXTRAS

## SUPPLEMENTS – FOR AND AGAINST

In general the recommendation would be to avoid the use of dietary supplements. But it is important to make an informed choice and think through the potential benefits against detrimental costs.

If considering supplements, make sure you have considered the following:

- indiscriminate use is unwise due to the very real health and contamination risks
- what are the costs? e.g. financial, health and performance
- what are the likelihood of contamination with banned substances?
- how substantial are the perceived benefits e.g. improved performance, better health – are they really necessary or are they being taken to insure against not having the correct diet?

Remember it is impossible to conduct a thorough analysis on every supplement as it is likely that there will be some unknown factors – especially if no scientific research has been carried out on the supplement or its proposed active ingredients.

If you feel it necessary to use a supplement, make sure it can be backed up by a substantial amount of scientific evidence. The evidence for a true benefit must be very strong to outweigh all the potential risks.

Finally, avoid dietary 'assessments' that can be designed to find faults in your diet that can only be corrected by taking supplements. Supplements are a more efficient way of making a profit than encouraging you to eat a healthy, balanced diet. As to whether they will improve sports performance, is another matter! If in doubt, seek advice from a sports nutrition professional.

Don’t forget the powerful placebo effect – just because you believe taking it is making you feel good – it doesn’t mean it actually does!

# 009

Q&A

## Q As a coach of a small club standard endurance group, I would like to give them some basic nutrition advice to supplement their training schedules. However, I don't want to bore them with too many details – just some good common-sense guidelines. What do you think I should be prioritising?

## A Correct fuelling is an essential part of preparation for endurance athletes and even knowing that your athletes reach the start line having eaten and hydrated well is something some people take for granted.

Endurance events can seriously deplete the stores of fuel and fluid in an athlete's body and the more intense, the more the stores can be depleted. An endurance runner who starts a race knowing they have paid attention to their food and drink choices in the days and hours leading up to the start, are far more likely to have the edge over an athlete who does not.

Some main considerations you may want to pass on to your athletes are:

### Carbohydrate and protein

Before any type of exercise, all athletes should aim to take in enough carbohydrate so that they can meet the requirements of their training schedule. Likewise, an athlete then has to ensure that they adequately restock the stores they have used up, either from a training session or a competition.

With your endurance athletes this is even more important and a key action they can take to enhance performance is to increase their intake of carbohydrate in the 2 or 3 days prior to the exercise, session or race.

Carbohydrates are present in many foods and drinks, but athletes may also consider energy bars, gels and liquid meals as a supplement to their

diet to help increase their carbohydrate intake. For very long endurance events such as marathons and ultra distance racing, athletes may want to aim for an intake of 30-60g per hour of exercise. Proteins are also important and can ensure that your athletes are consuming sufficient calories across the whole of their diet.

### Hydration

Performance can suffer if an athlete is not fully hydrated prior to starting exercise and water should be drunk in addition to sports drinks and food in order to contribute to the fluid required.

Although the intensity of the exercise is important, as a general rule athletes should aim to drink during an exercise if it lasts in excess of an hour. An example of this in action can be seen in some top athletes who may not require much water during the course of a half marathon race, however if they compete in a marathon they can be seen taking drinks on board from the very early miles.

Ideally, your athletes should opt for an isotonic sports drink that will help make sure fluids are replaced as well as delivering some carbohydrate. Some athletes prefer fruit juices or other types of sugary drinks, however as these generally contain no sodium, they may not be as good as opting for a sports drink.

### Where, when and what?

Almost as important as what your athletes eat is when they eat it and how much they eat! For example an athlete will benefit more from the carbohydrate they consume after exercise if they eat as soon as possible – 'the window of opportunity' to help enhance glycogen (carbohydrate) fuel storage. Likewise they need to start drinking as soon as possible in order to replace lost fluids and electrolytes from sweating.

Refuelling is a key part of the recovery process, and the sooner you can start your recovery, the better shape you will be in the next time you need to train or race. This is even more important if an athlete is training more than once a day and may have only a matter of hours before their next training session.

Endurance athletes should aim to have a high carbohydrate meal ideally 3-4 hours before their session or race although obviously race preparations and preferences in routine will differ from athlete to athlete. In order to ensure the athlete does not feel uncomfortable, it is recommended that the high carbohydrate foods are low in fibre as high fibre foods can be quite bulky and potentially cause stomach upsets. After exercise, regular carbohydrate intake every couple of hours will help refuel and should consist mainly of high

Glycaemic index foods such as:

- some breads, bagels and rice cakes
- some breakfast cereals, e.g. corn flakes, weetabix
- baked or mashed potatoes
- tropical fruits, e.g. watermelon and ripe bananas
- pretzels and plain popcorn
- jelly beans
- sports drinks

### Main points your athletes should know:

- plan your nutrition in and around an event as specifically as your training and tactics
- taper down your exercise during the few days where you increase your intake of carbohydrate to help maximise fuel stores
- plan and even practice eating and drinking up to, in and around events – don't experiment with a new approach before an important race!
- adjust your refuelling to take into account weather, temperatures and other external factors

# 009

Q&A

Q I am an athlete who mainly competes over the 60m and 100m although I have also competed in the long jump since I was young. I thought that I was pretty good at judging what was good for me in my diet but recently someone recommended I have a look at what I am eating to see if this makes a difference to my performance – particularly in terms of what I eat post track session.

The problem is there seems to be two schools of thought and everyone thinks they are right! On one side, lots of fellow athletes tell me that I ought to be prioritising carbohydrates – and previously that is what I was doing. On the other side, some sprinters in my group tell me carbohydrates will slow me down and I need to avoid them as a sprinter. Can you tell me who's right and who's wrong?

A First of all, well done for taking a look at your diet – it is always worth questioning what you are doing in your training and continually challenging yourself as to whether you have made the right decisions for your performance.

To answer your question, it is easy to see why people have come to these conclusions, but neither group are fully correct. As a sprinter, your need for carbohydrates will be less than that of a 10,000m athlete of course – and you probably shouldn't be challenging any of your endurance clubmates to a pasta eating contest! However

what mustn't be ignored is that carbohydrates are required to maintain muscular endurance and volume of strength training.

As a proportion of your intake should be protein based, it is sometimes thought this in turn means to reduce your carbohydrate intake. However, studies have shown that athletes who opt for a low carbohydrate diet will find high-intensity exercise performance is rapidly compromised.

### General guidelines

In order to get the balance right, try following these basic guidelines relating to carbohydrate intake.

### What to do?

After training, try to consume some carbohydrate within an hour of exercise finishing, as a guideline between 0.5g-1.0g of carbs per kg of body weight should be taken. However, the exact amount will depend on the intensity and duration of the session you have just finished. This would mean an athlete weighing 70kg should look to eat 35g-70g of carbohydrate inside that 'window of opportunity' (see chapter three on carbohydrates for lists of foods which fulfil this requirement).

### Why?

Carbohydrates can reduce the breakdown of muscle tissue post training session, glycogen is quickly replaced in the muscle and there is an improvement in how the body is able to absorb amino acids.

### What about protein?

Certainly combining some protein with your intake of carbohydrate can help promote the development of muscle – however the amount needed is quite modest perhaps only 10-20g of protein in a snack that is mainly carbohydrate based. This can then be followed by a balanced meal 1-2 hours later which also contains both carbohydrate and protein.

### How do I take in that protein? You've just said I should take in carbohydrate!

Fortunately, many of the carbohydrate based snacks can be combined with some protein to make a very good post training recovery snack. Here are some examples of foods that are easy for you to integrate into your post training routine:

- smoothies, low fat flavoured milk or yoghurt drinks
- breakfast cereal with low fat milk
- sandwich or baked potato with a protein based filling, e.g. low fat cheese, lean meat, chicken, tuna or egg plus a sports drink to help top up those carbs
- baked beans on toast
- low fat yogurt with fresh or dried fruit

### No great shakes

There are a number of protein based milkshakes, supplements and foods on the market aimed at athletes – these can often be found in health food shops, although more and more they are appearing on supermarket shelves. However, it should be noted that often these are not the best option for an athlete as they can contain excessive amounts of protein and very low levels of carbohydrate. You will not benefit from excessive amounts of protein as it will not build muscle and it is better replaced with the correct amount of carbohydrates to ensure energy is restocked. On a more serious note, you need to be aware of the risks associated with ingesting supplements which may be contaminated and result in an adverse anti-doping result. The safest approach is to realise that correct amounts of carbohydrate and protein can be ingested through normal food intake and it will probably be healthier for your wallet too!

### Main points to remember:

- protein is important to you but excessive intake is not required
- make sure you recover after a session by having a snack based on carbohydrate with some protein within an hour after the work out
- real food is recommended over supplements
- in looking after your post training snack, don't neglect your pre training preparations – make sure you have eaten properly and hydrated well

# 009

Q&A

Q I am 19 years old and on the world class talent programme and have been looking across the five rings model and making sure I question all factors that could affect my performance. I have been a vegetarian since the age of 12 and although I do not believe this has harmed me in any way, I would like to know if it is realistic for me to continue avoiding meat whilst training to be a world class athlete. Whilst some vegetarians I know can easily list several names of world beating athletes who avoided meat – I also can list several athletes who were widely reported as having to give up on being vegetarian as they suffered ailments which could be traced back to their diet.

I wouldn't like to have to eat meat again but I would rather work on the premise that prevention is better than cure! What do you think?

A It's a good question and one that there is no definitive answer to. I agree that whenever the question of being a vegetarian arises there is usually a great debate with examples of it working well or not.

Only you can decide if you want to change your diet – and what I would say is that a vegetarian diet can be as healthy but you do need to be aware of potential deficiencies that can – occur and box clever with your food choices!

The obvious risks with a vegetarian diet is lower levels of protein, iron, zinc, calcium, riboflavin, vitamins D and B12 – particularly if the diet is very

strict and dairy foods are also omitted in the case of vegans.

The table below shows some essential nutrients and what you may need to consume in place of meat and animal products in general.

### Four essential menu tips

It can be hard to keep track of every nutrient you need to be ingesting, especially when you are having to think of substitutes to meat products. Here are four quick wins you can make in your everyday diet to ensure you are covering many of the bases:

1 If you are not a vegan and choose to eat dairy products as a way of ensuring adequate intake of nutrients – opt for low fat versions to ensure fat intake does not rise too high

2 Good choices for snacks pre and post training session are dried fruit, nuts, cereal bars and bagels. Good toppings and fillings include peanut butter, hummous and low fat cheese

3 A low fat smoothie, milk or yoghurt drink is an excellent recovery drink for an athlete, vegetarian or not!

4 Breakfast cereals are not just for breakfast! They are a great way of boosting iron intake throughout the day

### Main points to remember:

- keep an extra eye on your diet to ensure you are not falling short on any essential nutrients
- additional vitamin C will enhance iron absorption
- make sure you include protein rich alternatives to meat including nuts, beans seeds and dairy products
- in making sure you include protein – don't neglect your carbs! Breakfast cereal, pasta, rice and potato will help meet your requirements!

| Nutrient | Found in | Non-meat alternatives |
|---|---|---|
| Protein | Meat and poultry products | Milk and dairy products, eggs, peas and beans, quorn/tofu/soy-protein, and grains, e.g. rice, pasta, breakfast cereals and breads |
| Iron* | Red meat, liver, offal products | Pulses, dark green leafy vegetables, eggs, nuts, seeds, dried fruit and fortified breakfast cereals and breads |
| Zinc | Red meat, fish, shellfish, poultry | Milk and dairy products, eggs, bread and cereals, green leafy veg, pulses |
| Calcium | Milk and dairy products (avoided if athlete is a vegan) | Fortified soy products, leafy green veg, pulses, nuts, seeds and white flour products, e.g. bread, breakfast cereals |
| Vitamin B2 (Riboflavin) | Liver and offal | Yeast extracts, green leafy vegetables, dairy products, fortified breakfast cereals and breads |
| Vitamin D | Oily fish | Fortified margarines, breakfast cereals and soya products |
| Vitamin B12 | Meat, fish and poultry | Eggs, dairy food, fortified breakfast cereals, yeast extract/vegetable stock and soya milk |

*To help with absorption of iron from plant foods, consume food rich in vitamin C, e.g. fresh orange juice as a drink or lemon juice over vegetables and fish

# 009

Q&A

**Q** My athlete is competing in a couple of grand prix this summer in Europe. She has been away with a GB team before, however that was a one off and was slightly different to the routine she will have. A couple of the events are close together so will mean her travelling straight from one to the other. She will then return to GB only to fly out again within 2 days. Do you have any tips for making sure her trips abroad don't compromise what I think has become quite a good diet routine recently, and also anything else we need to be considering?

**A** Travelling is a significant part of an elite athlete's life, yet despite this you would be surprised at how often some athletes are badly prepared for the journey. It doesn't seem to make sense – to put in all that work and hard graft in training only to perform badly because the journey wasn't considered in preparation!

Unfortunately eating and drinking correctly can be one of the first things to be neglected, but one of the biggest factors affecting performance! Luckily you recognise this.

The main areas of travel that can impact on the nutritional requirements of an athlete are:

- limitation of food available throughout a journey
- further limitations on refuelling caused by unexpected delays – long journeys can result in eating out of boredom
- time zone changes can interfere with eating and drinking routines
- type of travel can determine problems e.g. on a flight, air conditioning can be dehydrating and fluid quantities freely available may be smaller than required
- accommodation can vary widely – along with quality of food and facilities on offer
- stadiums and venues are not typically reliable venues to pick up a nutritious snack – choices available may be too high in fat and not enough

carbohydrate
- standards of hygiene and general safety vary widely from country to country
- cultural and language barriers can prevent you getting hold of what you want/need and you may be prevented from taking your own

### How to cope

Simple solutions to some of the problems above are as follows:

- pack and carry your own essential food and drink – chose options that you will be allowed to travel with and won't be confiscated at the airport or in customs!
- plan an eating and drinking routine and stick to it
- in certain countries it's important you avoid 'high risk' foods such as fruit without skins, ice cubes in drinks, salads, seafood and non-pasteurised milk and dairy products
- research in detail both the accommodation and the venue you will be at and what is likely to be available and plan around that accordingly
- if you are able to, choose your accommodation accordingly, and look at options for self catering and preparing your own meals and snacks
- eating out can sometimes help by having more control over what you order plus you may be able to ask for it to be prepared differently if the menu version does not suit your requirements, e.g. ask for sauces and dressings on the side; baked potatoes instead of chips
- learn how to ask for bottled water in the native language – and make sure any you do get is sealed when it arrives
- don't be influenced by your team mates/fellow competitors' choices – every athlete is different and your own personal routine is the most important thing
- don't experiment. You're competing – not on holiday!

### Foods that travel well

Cereals, muesli, energy bars, powdered milk, liquid meal supplements, dried and tinned fruit, low fat biscuits, jelly babies, and other dried non-perishable items.

### Drinks

Bottled water, sports drinks and sports drink powders.

## FOOD AND DRINK RECORD

WEEK COMMENCING:

PHOTOCOPY THESE PAGES AND USE THROUGHOUT THE YEAR

| MONDAY | Food and drink | How much? | CHO (g) | Protein (g) | Fat (g) |
|---|---|---|---|---|---|
| Breakfast | | | | | |
| Snack | | | | | |
| Lunch | | | | | |
| Snack | | | | | |
| Dinner | | | | | |
| Snack | | | | | |
| TOTAL | | | | | |

| TUESDAY | Food and drink | How much? | CHO (g) | Protein (g) | Fat (g) |
|---|---|---|---|---|---|
| Breakfast | | | | | |
| Snack | | | | | |
| Lunch | | | | | |
| Snack | | | | | |
| Dinner | | | | | |
| Snack | | | | | |
| TOTAL | | | | | |

| WEDNESDAY | Food and drink | How much? | CHO (g) | Protein (g) | Fat (g) |
|---|---|---|---|---|---|
| Breakfast | | | | | |
| Snack | | | | | |
| Lunch | | | | | |
| Snack | | | | | |
| Dinner | | | | | |
| Snack | | | | | |
| TOTAL | | | | | |

| THURSDAY | Food and drink | How much? | CHO (g) | Protein (g) | Fat (g) |
|---|---|---|---|---|---|
| Breakfast | | | | | |
| Snack | | | | | |
| Lunch | | | | | |
| Snack | | | | | |
| Dinner | | | | | |
| Snack | | | | | |
| TOTAL | | | | | |

| FRIDAY | Food and drink | How much? | CHO (g) | Protein (g) | Fat (g) |
|---|---|---|---|---|---|
| Breakfast | | | | | |
| Snack | | | | | |
| Lunch | | | | | |
| Snack | | | | | |
| Dinner | | | | | |
| Snack | | | | | |
| TOTAL | | | | | |

| SATURDAY | Food and drink | How much? | CHO (g) | Protein (g) | Fat (g) |
|---|---|---|---|---|---|
| Breakfast | | | | | |
| Snack | | | | | |
| Lunch | | | | | |
| Snack | | | | | |
| Dinner | | | | | |
| Snack | | | | | |
| TOTAL | | | | | |

| SUNDAY | Food and drink | How much? | CHO (g) | Protein (g) | Fat (g) |
|---|---|---|---|---|---|
| Breakfast | | | | | |
| Snack | | | | | |
| Lunch | | | | | |
| Snack | | | | | |
| Dinner | | | | | |
| Snack | | | | | |
| TOTAL | | | | | |

NOTES

# EXAMPLE OF CARBOHYDRATE PER DAY

A 55-60kg athlete (e.g. female endurance or sprinter, male endurance) training 2-4 hours per day would need to eat foods containing around 350-550g of carbohydrate per day.

| For example: | | grams |
|---|---|---|
| BREAKFAST | 60g cereal with 200ml semi-skimmed milk | 60 |
| | 2 slices of bread and 2 teaspoons of jam | 45 |
| | 200ml orange juice | 20 |
| POST TRAINING | Scone and a low fat fruit yoghurt | 35 |
| | Medium piece of fruit (e.g. pear, orange, apple) | 15 |
| | 500ml isotonic sports drink | 30 |
| LUNCH | 4 slices of bread | 60 |
| | Banana (large) | 35 |
| EVENING MEAL | Pasta (300g cooked weight) | 100 |
| | Broccoli and tomato based pasta sauce | 20 |
| | Apple (large) | 20 |
| TOTAL CARBOHYDRATE | | 440 |

NOTE: This selection is not designed to be a complete and balanced diet. It is meant simply to demonstrate the quantities of food providing sufficient carbohydrate. Only foods containing carbohydrate are listed. Carbohydrate values are rounded to the nearest 5 grams.

# EXAMPLE OF CARBOHYDRATE PER DAY

A 75-80kg athlete (e.g. male 400m and middle distance runners) training 2-4 hours per day would need to eat foods containing around 450-650g of carbohydrate per day.

| For example: | | grams |
|---|---|---|
| BREAKFAST | 60g cereal with 200ml semi-skimmed milk | 60 |
| | 2 slices of bread and 2 teaspoons of jam | 45 |
| | 200ml orange juice | 20 |
| POST TRAINING 1 | Scone and a low fat fruit yoghurt | 35 |
| | Medium piece of fruit (e.g. pear, orange, apple) | 15 |
| | 500ml isotonic sports drink | 30 |
| LUNCH | 4 slices of bread or 1 baked potato | 60 |
| | Banana (large) | 35 |
| POST TRAINING 2 | Bagel with honey | 50 |
| | Banana (large) or 50g raisins | 35 |
| | 500ml isotonic sports drink | 30 |
| EVENING MEAL | Pasta (300g cooked weight) | 100 |
| | Broccoli and tomato based pasta sauce | 20 |
| | Apple (large) | 20 |
| TOTAL CARBOHYDRATE | | 555 |

NOTE: This selection is not designed to be a complete and balanced diet. It is meant simply to demonstrate the quantities of food providing sufficient carbohydrate. Only foods containing carbohydrate are listed. Carbohydrate values are rounded to the nearest 5 grams.

# EXAMPLE OF CARBOHYDRATE PER DAY

An 85-90kg athlete (e.g. male sprinter or jumper) training 2-4 hours per day would need to eat foods containing around 500-700g of carbohydrate per day.

| For example: | | grams |
|---|---|---|
| BREAKFAST | 60g cereal with 200ml semi-skimmed milk | 60 |
| | 2 slices of bread and 2 teaspoons of jam | 45 |
| | 200ml orange juice | 20 |
| POST TRAINING 1 | Scone with jam or 2 scotch pancakes and a low fat yoghurt | 45 |
| | Medium piece of fruit (e.g. pear, orange, apple) | 15 |
| | 500ml isotonic sports drink | 30 |
| LUNCH | 4 slices of bread or 1 baked potato | 60 |
| | Banana (large) and 250ml flavoured milk | 60 |
| POST TRAINING 2 | Bagel with honey | 50 |
| | Banana (large) or 50g raisins | 35 |
| | 500ml isotonic sports drink | 30 |
| EVENING MEAL | Pasta (300g cooked weight) | 100 |
| | Broccoli and tomato based pasta sauce | 20 |
| | Apple (large) | 20 |
| | A tin of low fat rice pudding (425g) | 60 |
| TOTAL CARBOHYDRATE | | 650 |

NOTE: This selection is not designed to be a complete and balanced diet. It is meant simply to demonstrate the quantities of food providing sufficient carbohydrate. Only foods containing carbohydrate are listed. Carbohydrate values are rounded to the nearest 5 grams.

| rapidly absorbed carbohydrate ⟶ slower absorbed carbohydrate | | | |
|---|---|---|---|
| | High GI | Moderate GI | Low GI |
| SUGARS | glucose | sucrose<br>honey | fructose<br>lactose<br>jam |
| FRUIT | watermelon<br>lychee | banana<br>pineapple<br>apricot<br>paw paw | peach<br>apple<br>pear<br>orange<br>grape<br>plum |
| VEGETABLES | parsnip<br>pumpkin<br>broad bean | sweetcorn<br>beetroot | carrot<br>pea<br>baked beans |
| BREADS | french baguette<br>bagel<br>white bread<br>brown bread<br>wholemeal bread | pitta bread<br>crumpet<br>muffin<br>(e.g. bran,<br>blueberry) | fruit loaf<br>rye bread<br>granary bread |
| CEREALS | weetabix<br>cornflakes<br>bran flakes<br>coco pops | frosties<br>porridge | muesli<br>all bran |
| STARCHES | baked potato<br>mashed potato | white or brown<br>basmati rice<br>cous cous<br>sweet potato<br>boiled & new potato | pasta<br>lentils<br>yam |
| SNACKS | dried dates<br>pretzels<br>jelly beans<br>popcorn<br>rice cakes | raisins<br>sultanas<br>mars bar | dried apricots<br>peanuts<br>cashew nuts<br>fruit & sponge cake<br>chocolate |
| DRINKS | sports drink | soft drinks<br>squash | milk & yoghurt<br>apple juice<br>orange juice |

NOTE: Foods have been categorized according to their average GI value. Several foods cross two categories, e.g. most fruit values are between 40-60. GI differs between brands and also countries of origin. For example, some muesli and some rye bread will be moderate GI.

03

# SNACKS PROVIDING 50G (APPROX.) CARBOHYDRATE

| |
|---|
| 135g baked beans plus 2 medium slices of toast |
| 500ml isotonic sports drink and pot of low fat custard |
| 200ml orange juice and 2 slices of currant bread |
| 30g corn flakes, 1 large kiwi and 200ml of low fat milk |
| 250ml hot chocolate and a wholemeal scone |
| 35g jelly sweets and 150ml glass of orange juice |
| 150ml carrot juice, 3 rye crisp breads (cottage cheese to taste) plus 100g fresh pineapple and a small apple |
| 2 medium slices of toast, 2 teaspoons jam and 200ml skimmed/ semi-skimmed milk |
| 100g melon, 2 teaspoons honey, 150g pot low fat plain yogurt and 150ml apple juice |
| 100g grapes, 2 fig rolls and 150ml orange juice |
| Lean ham and salad sandwich (2 slices of brown bread) and 200ml glass of apple juice |
| 175g baked potato (with filling e.g. salad and prawns) |
| 120g sorbet and 200ml orange juice |
| 200g drinking yogurt and a fruit scone |
| 150g pot low fat plain yogurt, 1 digestive biscuit and 200ml apple juice |
| 1 crumpet and a teaspoon of jam plus 500ml isotonic sports drink |
| 250g home-made fruit salad (with equal proportions of banana, orange, apple, pear and grapes) plus 150g low fat plain yogurt |
| 1 toasted currant bun plus 200ml pineapple juice |
| Prawn and salad sandwich on 2 slices of light rye bread, plus 2 small tangerines and 200ml flavoured low fat milk |

# EXAMPLE OF PROTEIN PER DAY

A 50kg person undertaking regular activity would need to eat foods containing 50-60g of protein per day.

| For example: | | grams |
|---|---|---|
| BREAKFAST | 30g cereal with 100ml milk | 5 |
| LUNCH | Quarter tin of tuna in brine (50g) | 12 |
| | 2 slices of bread | 6 |
| EVENING MEAL | 50g chicken breast (grilled meat only) | 16 |
| | Pasta (200g cooked weight) | 13 |
| | Broccoli and tomato based pasta sauce | 6 |
| | Apple (large) | 1 |
| TOTAL PROTEIN | | 59 |

NOTE: This selection is not designed to be a complete and balanced diet and it may not contain enough carbohydrate to cover training. It is meant simply to demonstrate the quantities of food providing sufficient protein. Only foods containing protein have been listed. Protein values are rounded to the nearest gram.

# EXAMPLE OF PROTEIN PER DAY

A 75-80kg athlete (e.g. male middle distance runners) would need to eat foods containing 90-105g of protein.

| For example: | | grams |
|---|---|---|
| BREAKFAST | 40g cereal with 100ml milk | 7 |
| | 1 slice of bread | 3 |
| POST TRAINING | Scone and a low fat fruit yogurt | 9 |
| LUNCH | Half tin of tuna in brine (100g) | 24 |
| | 2 slices of bread | 6 |
| | Banana (large) | 2 |
| EVENING MEAL | 75g chicken breast (grilled meat only) | 24 |
| | Pasta (200g cooked weight) | 13 |
| | Broccoli and tomato based pasta sauce | 8 |
| | Apple (large) | 1 |
| TOTAL PROTEIN | | 97 |

NOTE: This selection is not designed to be a complete and balanced diet and it may not contain enough carbohydrate to cover training. It is meant simply to demonstrate the quantities of food providing sufficient protein. Only foods containing protein have been listed. Protein values are rounded to the nearest gram.

# EXAMPLE OF PROTEIN PER DAY

An 85-90kg athlete (e.g. male sprinter or jumper) would need to eat foods containing 100-155g of protein.

| For example: | | grams |
|---|---|---|
| BREAKFAST | 80g cereal with 200ml milk | 13 |
| | 3 slices of bread | 9 |
| POST TRAINING | Scone and a low fat fruit yogurt | 9 |
| LUNCH | Half tin of tuna in brine (100g) | 24 |
| | 4 slices of bread | 12 |
| | Banana (large) | 2 |
| | 250ml flavoured milk | 9 |
| EVENING MEAL | 100g chicken breast (grilled meat only) | 32 |
| | Pasta (300g cooked weight) | 20 |
| | Broccoli and tomato based pasta sauce | 8 |
| | Apple (large) | 1 |
| SUPPER | 80g cereal with 200ml milk | 13 |
| TOTAL PROTEIN | | 152 |

NOTE: This selection is not designed to be a complete and balanced diet and it may not contain enough carbohydrate to cover training. It is meant simply to demonstrate the quantities of food providing sufficient protein. Only foods containing protein have been listed. Protein values are rounded to the nearest gram.

| | |
|---|---|
| BEFORE EXERCISE | • Always start every exercise session well hydrated<br>• Drinking 400-600ml of water, sports drinks or other fluids in the 2 hours before exercise will help hydrate the body<br>• Before long or endurance events, drinking 300-500ml of fluid in the 10-15 minutes prior to the start may help the body to absorb fluid more effectively<br>• Avoid over-hydrating. For example, by using glycerol prior to exercise (in healthy individuals the kidneys will excrete the excess fluid before exercise begins) |
| DURING EXERCISE | • Aim to drink enough to limit fluid lost as sweat<br>• Try not to lose more than 1-2%, especially in endurance events in the heat<br>• This is calculated by taking body weight before and after exercise (see Table 9)<br>• Every athlete should develop their own strategy for drinking during sport where it is necessary<br>• For exercise that lasts over an hour, a guide might be to aim to drink 150-250ml every 15 minutes throughout exercise to offset fluid losses<br>• Drinking smaller volumes more frequently minimizes stomach discomfort<br>• Those undertaking prolonged exercise should be careful about the amount of fluid drunk. For example, running the average marathon will need 2-4 litres of fluid – that's about 250ml every 2 miles. Those taking a long time to complete an event should not drink large amounts frequently, so as to avoid over-hydration<br>• Don't drink so much that you actually gain weight during exercise |
| AFTER EXERCISE | • How much fluid you need depends on how much you have lost<br>• Drink 1.2-1.5 litres of fluid for every kg of weight lost during exercise |

| | |
|---|---|
| WATER | When sweat losses are small, water is fine. Under these conditions, salt can be obtained from meals and snacks eaten around training. |
| HYPOTONIC | These have a lower concentration than blood and so diluted soft drinks and sports drinks containing a small amount (under 4%, i.e. less than 4g per 100ml) of carbohydrate fall into this category.<br>Hypotonic drinks will generally provide fewer calories per 100ml than isotonic and hypertonic drinks.<br>Some athletes (e.g. those practising high intensity exercise) find these easier to tolerate and experience less stomach discomfort than when they use isotonic drinks. |
| ISOTONIC | Many commercial sports drinks are 'isotonic'. They usually contain 4%-8% (4-8g/100ml) carbohydrate and some salt.<br>They can be useful when exercise is prolonged and can be drunk before, during and after sport.<br>Sports drinks provide a source of carbohydrate, salt and fluid. |
| HYPERTONIC | These contain over 8% (greater than 8g per 100ml) carbohydrate and are less quickly absorbed than isotonic and hypotonic drinks.<br>Useful when energy and carbohydrate needs are high and sweat rates are lower, and also for refuelling after heavy exercise.<br>Fruit juice, energy drinks and sugary carbonated drinks fall into this category, but they generally don't contain salt and are not ideal to use to hydrate during exercise lasting longer than 1-2 hours. |

# NUTRIENT RICH FOOD SOURCES OF KEY VITAMINS

| MICRONUTRIENT | What does it do? | Good food sources |
|---|---|---|
| VITAMIN A (RETINOL) | Antioxidant function. Cell division and growth. Healthy skin and hair. Night vision. | Liver & offal, oily fish, eggs, whole milk, cheese, butter, margarine, spinach, broccoli, carrots, red peppers, tomatoes, dark green and orange vegetables. |
| VITAMIN B1 (THIAMIN) | Involved in the release of energy from food. Essential for nervous system. | Pork, liver & offal, lean beef, yeast extracts, red kidney beans, potatoes, fortified breakfast cereals, nuts, pulses and whole grains. |
| VITAMIN B2 (RIBOFLAVIN) | Metabolism of carbohydrates and fats. | Liver & offal, yeast extracts, green leafy vegetables, dairy products, fortified breakfast cereals and bread. |
| VITAMIN B3 (NIACIN) | Involved in the release of energy from food. | Meat, fish, wholegrain and fortified breakfast cereals, yeast extracts and coffee. |
| VITAMIN B6 (PYRIDOXINE) | Metabolism of carbohydrate, protein and fats. Important for immune function, formation of red blood cells and maintenance of healthy nervous system. | Fortified breakfast cereals, avocado, meat, liver, poultry, fish, eggs, nuts, bananas and soya beans. |
| FOLATE (FOLIC ACID) | Required for cell division and formation of proteins in the body. Extra in pregnancy protects against neural tube defects. | Green leafy vegetables, brussel sprouts, broccoli, spinach, lentils, oranges, fortified breakfast cereals, liver, yeast extracts, wholemeal bread, black eye beans and baked beans. |

# NUTRIENT RICH FOOD SOURCES OF KEY VITAMINS

| MICRONUTRIENT | What does it do? | Good food sources |
|---|---|---|
| PANTOTHENIC ACID | Involved in the release of energy from food. | Yeast, offal, peanuts, meat, eggs and green vegetables. |
| BIOTIN | Involved in metabolism of carbohydrates and fats. | Liver & offal, yeast, nuts, pulses, wholegrain cereals and eggs. |
| VITAMIN B12 (CYANOCOBALAMIN) | Essential for production of red blood cells and to prevent some forms of anaemia. Needed for a healthy nervous system. Used in carbohydrate, protein and fat metabolism. | Foods of animal origin e.g. meat, fish, poultry, eggs, dairy and fortified breakfast cereals. |
| VITAMIN C (ASCORBIC ACID) | Antioxidant. Healthy skin, gums, blood vessels. Haemoglobin and red blood cell production. Helps absorption of iron from plant foods. | Citrus fruits, berries & currants e.g. strawberries & blackcurrants; kiwi, broccoli, green peppers, cabbage, spring greens and potatoes. |
| VITAMIN D (CHOLECALCIFEROL) | Absorption of calcium and regulation of calcium metabolism; healthy bones. | Action of sunlight on skin. Oily fish, fortified margarines and breakfast cereals. |
| VITAMIN E (TOCOPHEROLS) | Antioxidant. Promotes normal growth and development. | Vegetable oils, wheatgerm, nuts, seeds, margarine, egg yolk and avocado. |
| VITAMIN K (PHYLLOQUINONE) | Essential in formation of certain proteins and normal blood clotting. | Green leafy vegetables e.g. spinach, broccoli, green cabbage and brussel sprouts. |

# NUTRIENT RICH FOOD SOURCES OF KEY MINERALS

| MICRONUTRIENT | What does it do? | Good food sources |
|---|---|---|
| CALCIUM | Strong bones and teeth. Muscle contraction, blood clotting and transmission of nerve impulses. | Milk and dairy products e.g. cheese and yoghurt; fish containing soft bones e.g. sardines and pilchards; fortified white flour products e.g. bread and cereals; dark green leafy vegetables; pulses and seeds. |
| MAGNESIUM | Involved in regulation of energy metabolism. Skeletal development, protein synthesis, muscle contraction and transmission of nerve impulses. | Vegetables and potatoes, meats, dairy, pulses, bread and cereals (particularly wholegrain), beer and coffee. |
| POTASSIUM | Works together with sodium to control fluid and electrolyte balance in cells and tissues. Regulates blood pressure. | Many plant foods including avocados, nuts, seeds, pulses, potatoes, tomatoes, whole grains and fresh fruit e.g. bananas, oranges. Also meat, fish and dairy. |
| IRON | Antioxidant function. Manufacture of red blood cells. Oxygen transport and utilization. Essential component of wide range of enzymes. | Red meat, liver & offal, fortified breakfast cereals, eggs, wholegrain bread and cereals, green leafy vegetables, pulses, dried fruit, nuts and seeds. |

# NUTRIENT RICH FOOD SOURCES OF KEY MINERALS

| MICRONUTRIENT | What does it do? | Good food sources |
|---|---|---|
| ZINC | Antioxidant function. Essential component of wide range of enzymes and vital for normal growth. Assists immune system and helps wound healing. | Fish and shellfish, red meat, milk and dairy, poultry and eggs, bread and cereals, green leafy vegetables and pulses. |
| COPPER | Antioxidant function. Essential component of wide range of enzymes. | Shellfish, liver, nuts, cocoa, meats, cereal products, vegetables and potatoes. |
| MANGANESE | Antioxidant function. Essential component of wide range of enzymes. Component of bone and cartilage. | Tea, bread and cereals (particularly wholegrain), brown rice, pulses and nuts. |
| SELENIUM | Antioxidant function. Essential component of wide range of enzymes . | Fish, meats, fats, vegetables, cereals, lentils, avocados and brazil nuts. |
| IODINE | Works together with thyroid hormones to control heat, protein synthesis and integrity of connective tissue. | Seafood and dried seaweed, milk and iodized salt. |

# EXAMPLE OF CARBOHYDRATE LOADING

A 50kg athlete would need to eat foods providing 400-500g of carbohydrate per day.

| For example: | | grams |
|---|---|---|
| BREAKFAST | 30g cereal with 100ml semi-skimmed milk | 30 |
| | 2 slices of bread or 2 crumpets with | 45 |
| | 2 teaspoons of jam | |
| | 150ml orange juice | 15 |
| SNACK | Medium piece of fruit e.g. pear, orange, apple | 15 |
| | 500ml sports drink or squash | 30 |
| LUNCH | 2 slices of bread | 30 |
| | 150g low fat fruit yoghurt | 10 |
| | Banana (large) or 50g raisins | 35 |
| SNACK | Bagel with honey or jam | 50 |
| | Medium piece of fruit e.g. pear, orange, apple | 15 |
| | 500ml sports drink or squash | 30 |
| EVENING MEAL | Pasta (200g cooked weight) | 65 |
| | Broccoli and tomato sauce | 15 |
| | Banana (large) | 35 |
| SNACK | 50g chocolate or cereal bar | 30 |
| TOTAL CARBOHYDRATE | | 450 |

NOTE: This selection is not designed to be a complete and balanced diet. It is meant simply to demonstrate the quantities of food providing sufficient carbohydrate. Only foods containing carbohydrate are listed. Carbohydrate values are rounded to the nearest 5 grams.

# EXAMPLE OF CARBOHYDRATE LOADING

A 70kg athlete would need to eat foods providing 560-700g of carbohydrate per day.

| For example: | | grams |
|---|---|---|
| BREAKFAST | 60g cereal with 200ml semi-skimmed milk | 60 |
| | 2 slices of bread or 2 crumpets with 2 teaspoons of jam | 45 |
| | 150ml orange juice | 15 |
| SNACK | Scone with jam or medium muffin or 4 Jaffa cakes | 35 |
| | Medium piece of fruit e.g. pear, orange, apple | 15 |
| | 500ml sports drink or squash | 30 |
| LUNCH | 4 slices of bread or medium baked potato | 60 |
| | 150g low fat fruit yoghurt | 10 |
| | Banana (large) or 50g raisins | 35 |
| SNACK | Bagel with honey or jam | 50 |
| | Medium piece of fruit e.g. pear, orange, apple | 15 |
| | 500ml sports drink or squash | 30 |
| EVENING MEAL | Pasta (250g cooked weight) | 80 |
| | Broccoli and tomato sauce | 20 |
| | 410g tin of fruit salad | 50 |
| | 150g low fat custard or ice cream | 20 |
| | 500ml squash or diluted juice | 30 |
| SNACK | 50g chocolate or cereal bar | 30 |
| TOTAL CARBOHYDRATE | | 630 |

NOTE: This selection is not designed to be a complete and balanced diet. It is meant simply to demonstrate the quantities of food providing sufficient carbohydrate. Only foods containing carbohydrate are listed. Carbohydrate values are rounded to the nearest 5 grams.

# EXAMPLE OF CARBOHYDRATE LOADING

A 90kg athlete would need to eat foods providing 720-900g of carbohydrate per day.

| For example: | | grams |
|---|---|---|
| BREAKFAST | 90g cereal with 300ml semi-skimmed milk | 90 |
| | 4 slices of bread or 4 crumpets with 4 teaspoons of jam | 90 |
| | 250ml orange juice | 25 |
| SNACK | Scone with jam or medium muffin or 4 Jaffa cakes | 35 |
| | Banana (large) or 50g raisins | 35 |
| | 500ml sports drink or squash | 30 |
| LUNCH | 4 slices of bread or medium baked potato | 60 |
| | 135g tin of baked beans | 20 |
| | 150g low fat fruit yoghurt | 10 |
| | Medium piece of fruit e.g. pear, orange, apple | 15 |
| | 500ml squash or diluted juice | 30 |
| SNACK | Bagel with honey or jam | 50 |
| | Banana (large) or 50g raisins | 35 |
| | 500ml sports drink or squash | 30 |
| EVENING MEAL | Pasta or rice (300g cooked weight) | 100 |
| | Broccoli and tomato sauce | 25 |
| | 410g tin of fruit salad | 50 |
| | 150g low fat custard or ice cream | 20 |
| | 500ml squash or diluted juice | 30 |
| SNACK | 50g chocolate or cereal bar | 30 |
| TOTAL CARBOHYDRATE | | 810 |

NOTE: This selection is not designed to be a complete and balanced diet. It is meant simply to demonstrate the quantities of food providing sufficient carbohydrate. Only foods containing carbohydrate are listed. Carbohydrate values are rounded to the nearest 5 grams.

# EXAMPLE OF PRE-COMPETITION MEAL

(i) A 50kg athlete would need to eat 50-200g carbohydrate. Below are seven different meals, each providing about 100g of carbohydrate:

1. 60g cereal with 200ml milk and large banana or 50g raisins
2. 3 thick slices of bread with honey or jam and 250ml fruit juice
3. Bagel, large banana and 500ml sports drink
4. Baked potato with 135g tin of baked beans and 200ml orange juice
5. 200g pasta with broccoli and tomato sauce plus a large apple
6. 100g cous cous with $^{1}/_{3}$ can of sweetcorn (100g) and 150ml fruit juice
7. 180g rice with 150g chick peas and a medium banana

(ii) A 70kg athlete would need to eat 70-280g carbohydrate. Below are seven different meals, each providing about 140g of carbohydrate:

1. 100g cereal with 300ml milk and large banana or 50g raisins
2. 4 thick slices of bread with honey or jam and 400ml fruit juice
3. 2 bagels, large banana and 500ml sports drink
4. Baked potato with 270g tin of baked beans and 400ml orange juice
5. 250g pasta with broccoli and tomato sauce plus two large apples
6. 125g cous cous with $^{2}/_{3}$ can of sweetcorn (200g) and 175ml fruit juice
7. 270g rice with 200g chick peas and a large banana

(iii) A 90kg athlete would need to eat 90-360g carbohydrate. Below are seven different meals, each providing about 180g of carbohydrate:

1. 150g cereal with 300ml milk and large banana or 50g raisins
2. 6 thick slices of bread with honey or jam and 400ml fruit juice
3. 2 bagels, 2 medium bananas and 750ml sports drink
4. 2 baked potatoes with 270g tin of baked beans and 200ml orange juice
5. 300g pasta with broccoli and tomato sauce plus large banana and apple
6. 150g cous cous with can of sweetcorn (300g) and 200ml fruit juice
7. 360g rice with 250g chick peas and a large banana

NOTE: Only foods containing carbohydrate are listed. Carbohydrate values are rounded to the nearest 5 grams.