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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

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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!

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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