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Introduction

Whether you are new to sport or you are a seasoned athlete looking to improve your overall performance nutrition plays an integral role.

There is not a generic answer when it comes to sports nutrition therefore a basic understanding of your body's requirements and how it can help you achieve more out of your training and racing is your key to success.

Now with the abundance of products pertaining to "increase performance" or "boost power output" it is not the lack of products that has become the problem, but the lack or impartial advice. Therefore, the more you know about your own nutrition requirements the more likely you are to see great changes in your levels of performance.

The information in this booklet is designed for the layman but with scientific information for those you want to know more.

The idea is to incorporate nutrition into your daily lives.

Fuel for Sport

When we exercise our hearts beat faster, our lungs work harder and blood is pumped faster around our bodies. Body heat and our physical movements are all the results of energy, even though we cannot see it.

Where does it come from and what is it?

In every cell in the body a process takes place converting a small molecule ATP to ADP. When this process takes place energy is produced. This energy is mainly given off as heat (this is why you feel hotter when you exercise) but a small amount is used as fuel for contracting muscles.

ATP is used up very quickly; therefore the body must burn more fuel to replace it.

In food there are four components that provide the body with a fuel to product energy. They are Carbohydrates, proteins, fats and alcohol (this is not covered in the document as alcohol is not a suitable energy source for sport)

The body will break food eaten into these components in the digestive system that are then absorbed into the blood system. They are all used for energy and other bodily functions.

Protein can be used by the body as an energy source but this only happens in certain, extreme circumstance. For example, the body uses protein as a source of energy when glycogen stores are depleted. This may occur towards the end of a long session or race. Something to note is that people who maintain a low carbohydrate diet whilst also exercising regularly may find they loose weight but this weight loss may be due to protein loss (i.e. muscle depletion).

Fat is used when as an energy source on a long-term basis. Long slow sessions may use more fat that short high intensity sessions.

Carbohydrates are used mainly for short-term energy whereas fats are used as a long-term energy source.

When carbohydrate levels are low the body takes its energy from protein as an emergency measure that is why if we do not have the correct carbohydrate levels for our activities our muscles are neglected.

THE SCIENCE OF ENERGY

For fuel, the body converts the three body fuels (carbohydrates, proteins and fats) into ATP (adenosine triphosphate).
As the name suggests, adenosine triphosphate (ATP) is made up of adenosine linked to three phosphate groups.

When one of the phosphates is detached from the adenosine energy is created, leaving ADP (one adenosine and two phosphate groups). This process creates energy that is used for muscle contractions but the majority of the energy is heat, hence the reason you feel warmer when you exercise.

There is enough ATP stored in the body for basic functions but when we start exercising this store is used up in seconds. Therefore the body must produce more by breaking down the three body fuels mentioned above.

Carbohydrates

As we have said, the main source of energy for our body is carbohydrate that is stored as Glycogen in the muscle and liver cells.

This said, the body can only store a small amount of glycogen at any one time and therefore needs to be replenished if we want to maintain our levels of energy.

So we look to food and drink to gain our daily carbohydrate requirements.

Carbohydrates provide the fuel for our bodies and can be found in a variety of foods. There are two types – Complex and Simple. For endurance sports it is advisable to gain most energy from Complex carbohydrates such as brown rice, oatmeal and sweet potatoes. These are broken down more slowly therefore providing lasting energy for the body to utilize. Simple carbs provide a rapidly absorbed source of energy and can be great for providing extra energy during long sessions or as a way to replenish your energy stores after a session. Sports drinks are a convenient way to take in carbohydrates whilst maintain your fluid levels.

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How much Carbohydrate do I need?

You can work out your body's daily carbohydrate requirement from level of exercise and your body weight. For example if you are training for 2 hours a day on a regular basis and your body weight is 75kg then your carbohydrate requirement would be: 450gram a day. This is a rough guide and is worked out by multiplying your body weight (in kilograms) by your exercise level:

Exercise level	Grams per body weight per day
1 hour of exercise a day	5
2 hours of exercise a day	6
3 hours of exercise a day	7
4 hours of exercise a day	8-10

Simple meals and snacks such as a banana sandwich, 7oz of cooked pasta and 2-3 slices of bread/ toast can provide 50grams of carbohydrates.

Start by looking at your current diet and work out the amount of carbohydrates you take in on a daily basis. You can then work out if you need to supplement this or change your diet. Remember to try and keep the calorie count low to maintain your current weight.

Plan your daily dietary requirements around your training. For example if you have a session at seven in the evening look to topping up your carbohydrate intake at 3-4pm. This can be as simple as a carbohydrate rich energy bar or a couple of bananas. Make sure your fluid levels are up during the session and if it last more than an hour use an energy drinks (such as SIS or High5) to top up your spent glycogen (energy stored in your muscle and liver cells) These drinks are quickly absorbed and provide a good source of carbohydrate energy.

Why start a session with half reserves of energy?

Replacing your glycogen levels after each session will mean that you will be fully recharged for the next time you train. This is imperative on the days you have more than one session. As a rule of thumb there is a two-hour window after a session where your body is more effective at absorbing these nutrients. There are a great range of recovery drinks available that also contain micronutrients to reduce muscle and joint soreness as well as providing protein and carbohydrates.

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Protein

As we have seen carbohydrate is our main source of energy and there protein is available for other bodily functions, namely muscle protection and repair.

How can protein help us?

Protein is needed by the body to promote the growth and repair of tissue. The intensity of our training will dictate the protein requirement. For example if you are working to increase your leg strength and are using weights in the gym and doing a lot of hill work on your bike then your protein intake needs to be increased to aid in the muscle recovery and repair. The more intense the session the more protein is broken down. If you are not supplementing your protein intake sufficiently then this may result in tissue breakdown, reduced muscle size and strength, which in turn will lead to the dreaded "overtraining syndrome"
So the first place to start is to work out your average daily protein intake. From this starting point you can begin to gauge any additional requirements based on the intensity of your sessions.

Experts recommend that athletes should look to consumer 1.1 and 1.8 grams per kilo of body weight per day. For endurance sports you should be looking to the lower end of this scale (perhaps 1.2 – 1.3g) whereas for muscular, explosive sports you should be looking to the higher end.

It has been shown that athletes who have a low glycogen level at the start of a session tend to burn more protein than those who have a high glycogen level.

So the key is balance.

Where should I get my protein?

With most sports lean muscle is the goal. Finding a way to pack on lean muscle without the added weight is one way of increasing the power available. But how can you achieve this?

As an athlete you must look beyond a simple diet and look further into the types of foods and supplements that can support your training.

Keeping your body lean means you have less weight to carry around and less stress on your joints so helping to avoid injury. So when looking at protein it is important to focus on lean protein.

You can find a good source of lean protein from chicken, tuna and egg whites. These are low in fat and high in protein helping you maintain race weight.

If you are looking to supplement your lean protein intake then look at Whey Isolate. This provides a great source of protein whilst maintain a low fat content.

Vegetarians can look to Soy protein supplements as a way to support their requirements.

Fat

Start with health assessment. Doctors and professional sports people use the Body Mass Index (BMI) to classify body weight to assess health risks and performance. The BMI gives a range for a particular persons height and therefore does not assume that there is an optimal body weight for a set persons height.

The simple calculation of your BMI is as follows:

YOUR WEIGHT (Kg) Divided by YOUR HEIGHT(square metres)

For example my weight is 75kg and I am 1.83m high.

Therefore my BMI = 75 / (1.83 * 1.83)

BMI = 22.09

We then compare this to the BMI Classification Table below:

Result	Classification	Grade	Health Risk
Less than 20	Underweight		
20 to 24.9	Normal	Grade 0	
25 to 29.9	Overweight/plump	Grade 1	
30 to 40	Moderately Obese	Grade 2	
40 plus	Severely Obese	Grade 3	

As you can see the BMI classification is not an exact science and should be used as a rough guide. There are also certain limitations with the BMI. For instance it does not take into consideration that athletes have more muscle weight than those who are elderly where muscle deterioration may have taken place. But it's a good starting point.

Fat distribution has been highlighted as more important than total body fat measurement. For example fat stored around your stomach area carriers a bigger health risk that fat stored in your hips or thigh area.

A high majority of where we store fat is down to our genetic build, for example women tend to store fat around the hips, thighs and triceps whereas men's bodies tend to favor the stomach for fat deposits. Your fat distribution can be measured using another simple calculation: The Waist Circumference Test. Simply divide your waist circumference by your hips circumference. The resulting figure should be less than 0.95 for men and on or below 0.8 for women.

If the resulting value is greater than these figures then this suggests excess fat in the abdomen and can result in a higher health risk.

As you can see, these tests provide a simple basis to assess your health risk. Further body fat tests can be used to more accurately measure the amount of body fat you may have for example underwater weighing, bio-electrical impedance and skinfold measurements but these will not be covered in this document.

Fat and the athlete

So now we can look at fat and how it affects the athlete. If we start with the body that is made up of two types of tissues, lean tissue and fat tissue. Lean tissue such as muscles, bones and blood are active, functional tissues whereas fat tissues are non-functional tissues as far as athletes are concerned.

The higher the percentage of functional tissue compared to non-functional tissue the more effective the athlete will be.

But we should not aim to remove fat from our diet completed. Certain fats can provide the athlete with support for training and aid in your overall health.

For example most of us see fat as bad for us and we are constantly reminded that we should reduce our fat intake. The message is slightly confusing as in one sense it is wise to reduce fat intake but on the other there are certain fats that the body needs and will assist the body in coping with the demands sport place on our bodies. Fat is used for energy. As mentioned in the section on Carbohydrates, fat is used during energy production throughout the day.

What are good fats?

There are several different types of fats – saturated, monounsaturated, polyunsaturated and essential fatty acids. Some good, some bad.

Saturated fats are classed as the "bad" fats and are looked upon as the causing fats in heart disease due to its ability to raise cholesterol.

Monounsaturated fats are classed as the "good" fats (such as olive oil, nuts and seeds) and unlike saturated fats, they can lower cholesterol.

Polyunsaturated fats are the middle of the road fats and provide some benefits whilst also adding to the effects of saturated fats.

This brings us to essential fatty acids. These are the triathletes friend.

Essential fats such as Omega 3,6,9 which are primarily found in fish provide a good source of "good" fats. These will help keep your joints supple and some research has shown them to help lower cholesterol and the risk of heart attack. Therefore eating oily fish will not only add protein to your diet but will also assist your bodies ability to adjust to the stresses of training. If you need to supplement this intake you can look towards Fish Oil supplements.

In conclusion fats can help the body to function correctly and therefore should not be overlooked by the serious triathlete. As with most things, moderation is key. Aiming for 15-30% of fat in your total calorie intake is recommended and try to move more towards the good fats.

Nutrition For Sport: Putting it into practice

This section will take the above information and put it into practical terms for athletes.
As an example we will look at the annual requirements of a triathlete.
Annual Stages

Build

Once a race season is over and the triathlete has wound down and recovered from intense racing and training they tend to look toward the build phase. This is where weaknesses found during the last season can be worked on and the focus is more towards building strength and power rather than muscular and physical endurance.

During this phase the triathlete may spend more time in the gym strengthening leg and chest muscles. This means the body will require more protein to assist recovery and development of muscle tissue. Try not to neglect your carbohydrate intake, as this will help you maintain your enthusiasm and focus whilst in the gym and also assist in your body's ability to absorb protein.

Using weights to increase your muscle size and power also puts extra stress on your joints. Along with your regular stretching routine look towards protecting your joints by using such products such as Glucosamine and adding extra essential fatty acids (such as fish oils) to your diet. As mentioned before oily fish will add extra protein as well as essential fatty acids.

This phase is also useful for focusing on technique, whether this is your stroke in the pool or your cycling position.

Prep

This stage will see the triathlete moving more towards building endurance and will mean longer hours on the bike and more road work.

Run: More work on your running endurance will mean a lot more pressures on your joints. Again, supplementing your diet with joint protecting products will help you avoid injury. And at this key stage of your season, even a small niggling injury can result in a season long problem. Recovering after each run should not only consist of your stretching routine, but also incorporate nutritional recovery. Remember the two-hour window after a session where you body is more effective. A Good recovery drink, such as REGO Total Recovery by SIS, will give you the carbohydrate and protein requirements and also contains micronutrients to help reduce muscle and joint soreness.

Bike: Long hours in the saddle are key to increasing your endurance. The sessions will be longer but not necessarily high in intensity. The aim here is to increase the length of time you are out on your bike. Intensity can come later.

Therefore from a nutritional perspective, look towards keeping hydrated and maintaining your energy. Depending on the length of your session, keep two bottles available. One with a carbohydrate rich drink and the other with water in it. This will provide good hydration during the first 60 minutes of training and then carbohydrate replacement thereafter. If you are training for half Ironman, Ironman or long distance triathlons then feeding whilst on the bike is key. This can take the form of energy bars (rich in carbohydrates and low in fats), which are convenient for eating whilst on the move. Building a feed plan into your early training means come race day you body will be used to feeding whilst training. Race day is not the best time to find out that your body rejects the energy food you have taken after two hours on the bike.

As with running, look to recovery as the most important part of your nutrition plan. Repairing you muscles after a long ride will mean you will recovery quickly and be ready for the next session. This helps you avoid the over training syndrome, where your energy levels cannot maintain your training demands and therefore each session becomes harder and harder with no noticeable gains.

Swim: The time spent in the pool during the prep phase will be mainly building your endurance with some sessions focusing solely on technique. Hydration is key. It is sometimes thought that you do not need to drink as much or look to hydration whilst swim training but this is a myth. You are exercising as hard as you would on the bike and so taking a bottle to poolside is advisable.

Muscular endurance

This phase can produce the hardest demands on your body with endurance being tested with increased intensity. For example more hill work on the bike or run and more distance in the pool. This is the phase where the two earlier phases are combined. Therefore your nutrition plan must be maintained.

Remember the three key areas – Carbohydrates, Protein and essential fats.

Look towards supplements to assist your nutritional requirements. Extra protein and certainly carbohydrate rich drinks are products that will assist your training and support your body's developments.

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Incorporating Nutrition into your training/racing

As with all the phases of training and racing there are three key times to focus on nutrition. Before, during and after.
Before
Before a race or session is a good time to make sure you are fully fuelled and ready for what lies ahead. Three hours before a session/race look to increasing your carbohydrate intake. A carbohydrate rich meal that is low in fat will increase your glycogen levels.

1-30 minutes before training/racing top up your carb levels with a carbohydrate rich drink.

TIP: Finally, do not eat something before the race that you have not already tried in training. You body may reject it and could result in stomach crams or vomited, neither of which is nice when you are surrounded by 200 people in the water!

During

One of the most important areas to look to is maintaining hydration during your training/racing. Feeling thirsty is an indicator that you might already be suffering for dehydration. Drink in small amounts more frequently and if you are training indoors or outside in a hot climate look to replacing your electrolytes as well (see the section on General Nutrition for more information.)

If you are looking at the longer sessions (over 60 minutes) then refueling whilst training is key. If you are a cyclist then feeding on the bike can be as simple as a carbohydrate rich snack such as an energy bar or gel will provide you with added carbohydrates in a convenient form and are also quickly absorbed by the body. If you decide to use gels then remember to take fluid soon after.

Recovery

As mentioned, recovery from a race/session is an area that will give you great benefits. When putting pressures on your body it is imperative you support this with correct nutrition. Taking a recovery product will not only aid your bodies ability to adapt to the extra stresses it will also help you recover faster and make sure you are ready for your next session.

The Foods

What is the Glycemic Index (GI)

The glycemic index is a way to rank carbohydrates based on their immediate effect on blood glucose (blood sugar) levels. By comparing foods carbohydrate content you can work out which foods are better for different stages of training. For example carbohydrates that breakdown quickly during digestion have the highest glycemic indexes and will provide a quick source of energy whereas low glycemic indexes will breakdown slowly and provide longer lasting energy by releasing glucose gradually into the blood stream.

Low GI Foods

Smaller rise in blood glucose levels after meals.
Diets can help people lose weight and improve the body's sensitivity to insulin.
These foods keep you fuller longer and can prolong physical endurance as they provide a more stable, slower to be absorbed form of carbohydrates.

High GI Foods

These foods help re-fuel carbohydrate stores after exercise and provide a quickly absorbed energy source. As with most things, balance is key. Mix you diet with high, medium and low-level carbohydrates. Simply focusing on high GI foods will mean you will have short lasting energy bursts, sometimes followed by a sugar depletion leaving you exhausted and lethargic.

Sample GI Foods

Fruit

Type	Glycemic Index (GI)	Classed
Apple	38	Low
Banana	56	Medium
Dates	103	High

Pasta

Type	Glycemic Index (GI)	Classed
Fettuccini	32	Low
Linguini	50	Medium
Spaghetti	33	Low

Beans/Pulses

Type	Glycemic Index (GI)	Classed
Soy (boiled)	16	Low
Baked Beans	44	Medium
Canned Kidney Beans	52	Medium

Breads

Type	Glycemic Index (GI)	Classed
White	70	High
Bagel	72	High
Rye	64	Medium/High

Root Vegetables

Type	Glycemic Index (GI)	Classed
Baked Red Potato	93	High
Sweet Potato	52	Medium
Boiled White Potato	63	Medium/High
Yam	54	Medium

Sugars

Type	Glycemic Index (GI)	Classed
Fructose	22	Low
Honey	62	Medium
Maltose	105	High
Table Sugar (white)	64	Medium/high

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General Nutrition Information

Dehydration

When you exercise you loose body fluids through sweat and water that evaporates through the air that you breath out. The more your body heats up the more fluids you loose, this is the bodies way of maintain a save core temperature. Therefore it is important to replace these fluids before the onset of dehydration.

To avoid dehydration look to increasing your fluids prior to any exercise. Then during a session remember to look to replacement. Smaller amounts more often are more advisable than larger amount less frequently. Look to taking small sips every fifteen minutes whilst on the bike and at each run drinks station during a race. During a race do not take on any type of fluid (except water) that you have not already tried and tested during your training. If you do you run the risk of it not agreeing with your system.

If you are exercising for less than 30 minutes then the risk of dehydration is a lot less. So for those of you that do training longer than this time, pay close attention to what your body is telling you.

When you have finished drink plenty of fluids. This will replace what has been used during the session/race. Waiting till you are thirsty means you are already dehydrated.

Hyponatraemia – Is it possible to drink too much water?

It is uncommon but possible to drink too much water. Long distance endurance athletes train and race for long periods of time during which it is advisable to replenish fluid levels. The body has an ability to expel excess fluids that it does not need but during excessively long sessions (marathons, ironman distances etc) and when only water is used then the body may be lacking sodium concentration in the blood. This lack of blood sodium can cause the athlete to want to urinate more and have a reduced feeling of thirst, which in turn causes dehydrate. To help avoid this drink electrolyte drinks which contain levels of sodium especially if you are training hard and long and are sweating heavily.

There are a range of symptoms including nausea, muscle cramps, disorientation, slurred speech and confusion. If left untreated it can progress into seizures or coma and immediate medical assistance should be sought.

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What are Electrolytes?

Electrolytes are minerals in your blood and other body fluids that carry an electric charge. It is important for the balance of electrolytes in your body to be maintained, because they affect the amount of water in your body, blood pH, muscle action, and other important processes. You lose electrolytes when you sweat, and these must be replenished by drinking lots of fluids.
There are a number of sports drinks that contain electrolytes available. If you are training indoors, in a hot climate or are a person who sweats a lot then look to Electrolyte drinks as a way to replace energy and electrolytes.

What is an Isotonic Drink?

An isotonic solution/drink has the same salt concentration as the normal cells in the body and the blood. An isotonic drink is quickly absorbed and replaces fluid and minerals, which the body uses during physical activity. These types of drinks provide a good balance between refueling and hydration.

What does Hypertonic mean?

A Hypertonic drink contains more particles than the body fluids and is therefore absorbed more slowly than water.

The Available Supplements

This section highlights the available products for athletes and their uses.
Remember any questions regarding these products can be sent to: info@fuelsport.co.uk or we can be contacted on 0800 652 4750.

Energy Drinks

Mainly carbohydrate rich, these drinks provide energy for exercise. Most come in a powder form that are mixed with water. This has the added benefit of provide extra fluids. They can be Isotonic allowing fast absorption and some contain electrolytes.
If your sessions are longer than 60 minutes then look to replace spent glycogen and fluids by using an energy drink.

Energy Gels

Gels are a relatively new concept in the world of nutrition. Fundamentally they are a carbohydrate concentrate that comes in a convenient pouch. They can be taken on the bike or during a run and are quickly absorbed into the body to provide energy within about 15 minutes. The main thing to remember when taking gels is that most require around 200ml of water to be drunk immediately after. Also worth noting is that SIS has produced an isotonic Gel that requires less water than the standard gels and are rapidly absorbed.

Energy Bars

As a food source, energy bars provide a good, high-energy snack. Most are low in fat and proteins with most of the nutritional value being carbohydrates. They can be used during the day to top up your carbohydrates. For example those of you that training during lunchtimes or early evenings, energy bars can be used as a mid morning or mid afternoon snack to make sure your glycogen levels are topped up prior to a session.

For those of you that train longer than 60-90 minutes then they are also a convenient way to add carbohydrates to your body during a long ride.

Protein Recovery Drinks & Bars

These products are the athlete's best friend. As we all know, training can be long, hard and the frequency of sessions means that unless we pay close attention to our nutritional requirements we can quite quickly spiral into over-training. You will notice this when you push hard in a session with relatively no gains.

Therefore recovery drinks provide a good source of proteins, carbohydrates and nutrients to help your body recover. If you replace your glycogen, aid muscle repair and reduce joint soreness after each session you will be more focused and active in your next session.

"You are only as good as your last recovery!"

Creatine Monohydrate

There is always a lot of discussion about Creatine supplementation and it's uses. Below is some information that should help anyone looking at Creatine as part of their nutrition program.

Creatine is found in certain foods in our normal diet, foods such as raw fish provide a natural source of Creatine. The body uses Creatine in energy production and is found in your muscles.

The body produces energy by the break down and recycling of ATP (as mentioned at the start of this booklet). The body can only store limited amounts of ATP (about 30-60 seconds worth during a high intensity burst of energy). Therefore the body replenishes this store via the breakdown of carbohydrates. Sometimes the body does not break down carbohydrate quick enough and therefore seeks an immediately energy source – Creatine phosphate. Creatine phosphate "lends" its recharge capability to ATP production that can then be replaced once the carbohydrates have chance to aid energy production.

Creatine Phosphate can recharge ATP energy faster than carbohydrate but also only has a short, explosive supply. Therefore more Creatine phosphate in your system can add explosive power to the athlete.

Supplementing your bodies natural store of Creatine helps the athlete to increase their explosive power and is useful for short intense workouts such as gym work, sprint distances and short power focused rides.

Things to consider if using Creatine Supplementation

Some research has shown that taking Creatine supplements with carbohydrates increases their absorption rate.

If you have optimum Creatine levels in your system then you will not see any increased performance from using Creatine supplementation.

Creatine loading prior to a race may give the athlete the affect of more lean muscle mass but this may be due to water retention during this loading phase which will dissipate.

Using Creatine means your carbohydrate stores will be used more quickly.

Make sure you maintain your hydration levels.

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Glucosamine

Laboratory studies suggest that Glucosamine may stimulate production of cartilage-building proteins.

Glucosamine is an amino sugar produced from the shells of shellfish and is a key component of cartilage. Glucosamine works to stimulate joint function and repair. It has been proven effective in numerous scientific trials for easing osteoarthritis pain, aiding in the rehabilitation of cartilage, renewing synovial fluid, and repairing joints that have been damaged from osteoarthritis.

We all produce an amount of Glucosamine within our bodies but as we grow older our capacity to make enough reduces. Putting extra stress on our joints through long training and high impact sessions such as running causes inflammation in our joints. Having ample Glucosamine in your body is essential to producing the nutrients needed to stimulate the production of synovial fluid, the fluid that lubricates your cartilage and keeps your joints healthy.

It is key to look after your joints, especially the knees, as small injuries soon become lasting reasons why your season is cut short.