

# ATHLETICS OMNIBUS – NUTRITION IN ATHLETICS

From the Athletics Omnibus of Richard Stander, South Africa

## NUTRITION

Nutrition denotes all the food a person eats or drinks. What we eat, when we eat and how we eat will determine the quality of our performance. Food is the fuel of the body. The body transforms food into energy, which is needed, for movement, growth and a healthy body.

### 1. CALORIES

The energy the body gets from food is measured in calories. The number of calories a person needs depends on:

- 1.1. Your physique (body build)
- 1.2. Your age
- 1.3. What sex you are
- 1.4. How active you are
- 1.5. Your state of health
- 1.6. How efficiently your the body uses food

### 2. METABOLIC RATE

The metabolic rate is the rate at which a person converts food to energy. The metabolic rate can increase during exercise. Growing uses a lot of energy and the energy requirements during the ages 12 - 17 are normally the highest. Young athletes must eat well to perform well.

### 3. ENERGY BALANCE

The energy balance of an athlete is crucial. If an athlete does not take in sufficient calories, the athlete's performance will be reduced. If an athlete takes in too many calories, the body will store the calories as fat tissue. Body weight increase will also reduce performance. The table below illustrates the various energy requirements in calories:

Body weight in kg	50	55	60	65	70	75	80	85	90
Basic energy requirement in calories per day + approximate extra energy requirement in calories when training 2 hours / day	1600 + 1 of:	1760 + 1 of:	1920 + 1 of:	2080 + 1 of:	2240 + 1 of:	2400 + 1 of:	2560 + 1 of:	2720 + 1 of:	2880 + 1 of:
General workout in a gym	850	935	1020	1105	1190	1275	1360	1445	1530
Sprints, hurdles, jumps, vaulting	1600	1760	1920	2080	2240	2400	2560	2720	2880
800 m - 3000 m sc, combined events	1750	1925	2100	2275	2450	2625	2800	2975	3150
Throws	1900	2090	2280	2470	2660	2850	3040	3230	3420
5000 m - marathon, walks	2000	2200	2400	2600	2800	3000	3200	3400	3600

From the table, a sprinter weighing 65 kg and training 2 hours daily, will need  $2080 + 2080 = 4160$  calories.

These figures are not accurate. They are only a broad guideline. The main producers of energy are carbohydrates, fats and proteins, in that order. From the table below you can see in what ratios these three sources should be taken in.

### 4. RECOMMENDED HIGH PERFORMANCE DIET

From these percentages any qualified dietician will be able to work out a menu that will suit the athlete's needs.

% DAILY CALORIES	FOOD TYPE	EXAMPLES OF FOOD
60 - 65%	carbohydrates (4 cal / gm)	rice, pastas, potatoes, sweets, bread
20%	fats (9 cal / gm)	vegetable and animal fats, dairy produce
15 - 20%	proteins (4 cal / gm)	eggs, milk, beef, fish, soya, etc.

## 5. NUTRIENT BALANCE

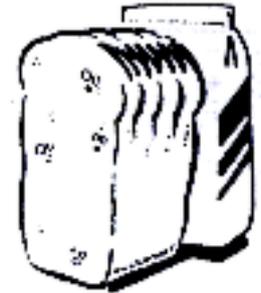
With the energy level balanced it is necessary to balance the total nutrient intake. The six classes of nutrient needed to balance the diet are:

- 5.1. Carbohydrates
- 5.2. Fats
- 5.3. Proteins
- 5.4. Vitamins
- 5.5. Minerals
- 5.6. Fibre
- 5.7. Fluids

### 5.1. CARBOHYDRATES

Carbohydrates are the main source of energy. They are compounds of hydrogen, carbon and oxygen, and are broken down by the body to our most important fuel - glucose. They have fewer kilojoules energy per gram than fats, but are more important. Carbohydrates are the easiest nutrient to transform into energy.

The nervous system and muscles are dependent on the sufficient supply of blood sugar. In fact, the brain uses only blood sugar to function properly.



During a long distance race, the body will start using fats as energy source only after the carbohydrate stores have been depleted.

**Carbohydrates from natural or complex sources such as rice, wheat, potatoes, spaghetti, fruit, etc., should be the main ingredient of any diet.**

- They have a balance of other nutrients such as the vitamin B group responsible for absorbing the carbohydrates into the body.
- They enter the blood more slowly and produce fewer insulin hormones, which are responsible for removing glucose from the body quickly.
- Because of the slow release, more energy is available, and less is stored as fat.

**Concentrated or refined carbohydrates such as white sugar, honey, soft drinks and chocolate bars are quick but poor sources of energy.**

- They are high in calories, but low in other nutrients.
- They enter the blood more quickly, but produce more insulin hormones. The insulin removes glucose from the body very quickly, and makes the athlete feel low in energy within an hour after intake.

The athlete should never reach a state of total depletion of energy reserves during training, because it can take up to a week to refill the energy stores.

### 5.2. FATS

Fats are a very concentrated source of energy and produce twice as much energy as carbohydrates, but require 10% more oxygen to release the energy. They also consist of compounds of hydrogen, carbon and oxygen. The intake of fats should be limited for the following reasons:

They stay in the stomach too long, and therefore reduce performance. A high fat content in the blood postpones the use of carbohydrates as a source of energy. They require more oxygen to operate.

They are stored under the skin and inside the muscles. A controlled amount of fat intake is necessary to allow the absorption of fat-soluble vitamins. The two main sources of fat are:

- Animal fats
- Vegetable fats.



The intake of saturated animal fats, which are found in red meat, cheese, and dairy products, should be reduced because they have high fat contents and give you a feeling of over eating for a long time after intake.

Saturated fats such as fish, chicken and veal should rather be eaten because of their lower fat contents. An athlete should concentrate on the intake of unsaturated vegetable fats such as margarine, olive oil, sunflower oil, peanuts, etc.

They are responsible for the reduction and utilisation of cholesterol in the body. Cholesterol plays an important role in the body. It is responsible for cellulation, as well as the production of gall salts responsible for breaking up fats and fat soluble vitamins such as A, D, E and K.

Cholesterol is also responsible for the production of natural steroid hormones necessary for the development of strength in the body.

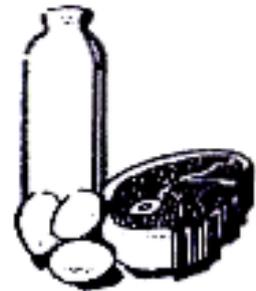
Fats give food flavour. Better tasting food causes the body to produce more saliva, acids in the stomach, gall from the gall bladder and digestive juices from the pancreas. This leads to better and faster digestion of food in the body.

### 5.3. PROTEINS

Proteins are responsible for the growth and repair of cells. Some types of cell, such as red blood cells, only last a few weeks before being replaced.

Proteins are the main nutrient responsible for building new tissue, muscles, blood, skin, bone, nails and connective tissue.

There is a constant need for regular protein intake. It is the only nutrient that contains nitrogen and sulphur.



There are no alternatives for proteins amongst the nutrients. Proteins are made up of building blocks called amino acids. The digestive system (liver) breaks down the protein foods to amino acids. Proteins cannot be stored in the body and must be taken in daily.

There are 21 known types of amino acid, which combine in different ways to make different proteins. Eight of the amino acids used by the body cannot be manufactured by the body, and must be supplied by the proteins. They are called essential amino acids.

The protein quality is judged by how many of these eight amino acids they contain. At the top of the range are:

100%	Eggs
83%	Beef
80%	Milk
79%	Oats
73%	Soya
70%	Fish

The protein haemoglobin is the main substance of the red blood cell in the body, and is responsible for carrying oxygen to the muscles.

Intensive training reduces the life-span of red blood cells from 120 days to as few as 20 days.

Proteins also provide heat and energy to the body when the carbohydrate and fat stores near depletion. Athletes normally require between 1gm and 2 gm proteins per kg body weight per day.

Higher intensities of training require more proteins. Weight lifting and the throws need even more.

Protein supplements are available on the market today. They are normally taken in liquid form and are easily digested. But be careful.

Too much protein will increase muscle and body weight, which reduce the level of performance.

## 5.4. VITAMINS

Vitamins are needed in small quantities daily.

They play an important role in many chemical processes that take place in the body.

Without vitamins, most minerals cannot be absorbed into the body.

There are two types of vitamins:

- fat-soluble vitamins
- water soluble vitamins.

Fat-soluble vitamins are stored in the body ready for use. Of the 13 vitamins required by the body, four vitamins (A, D, E and K) are fat-soluble while the others are water-soluble.

Vitamins are found in different proportions in all natural foods, and are highest in fresh raw vegetables.

The amount of vitamins in the food is reduced when cooked, baked, canned, frozen or stored for long periods of time. Raw, uncooked vegetables are best, followed in order by steaming, baking, boiling and frying.

Vitamins A, B complex, C, E, and P are the most important ones for the endurance events. The function and chief sources of the more important vitamins are as follows:

VITAMIN	MAIN FUNCTION	MAIN SOURCES
A (Retinal)	Growth & repair of skin and mucous membranes, as well as eyesight	Margarine, butter, milk, liver, egg yolk, carrots
B1 (Thiamine)	Carbohydrate break-down Improves nervous system, reduces exhaustion, depression	Brown bread, meat, vegetables, potatoes, milk, pulses
B2 (Riboflavin)	Carbohydrate, fat and protein break-down to energy	Milk, milk products, brown bread, meat, fish, vegetables
B6 (Pyridoxine)	Protein metabolism	Bread, milk, vegetables, eggs, meat, nuts
B12 (Cyanocobalamine)	Red blood cell formation	Meat, liver and other animal foods
Niacin (A <sub>s</sub> B <sub>2</sub> B complex)	Fights nervousness and helps with digestion system	Brown bread, meat, fish
Folic acid ( B complex)	Red blood cell formation	Liver, raw green vegetables, pulses
C (Ascorbic acid)	Protein metabolism, iron metabolism, energy metabolism, defence against infection	Fruit, vegetables
D (Cholecalciferol)	Bone formation. Regulates intake of calcium and phosphorus	Sunshine, margarine, butter, egg yolk, fish oil
E (Tocopherol)	Muscular action. Also helps vitamin A	Wheat germ, vegetable oils, egg
K	Clotting of blood	Green vegetables

## 5.5. MINERALS

Minerals, like vitamins, are needed in small daily amounts.

These 'inorganic' elements are crucial for the proper functioning of nerves and muscles.

They also help build body structures such as bone, teeth, muscles and skin.

A well-balanced diet will normally supply all minerals needed for health.

The function and chief sources of the more important minerals are as follows:



MINERALS	MAIN FUNCTION	MAIN SOURCE
Iron	Oxygen transportation - form haemoglobin in red blood cells	Brown bread, meat, eggs, yeast, raisons, vegetables, nuts
Calcium	Makes bones and teeth, muscle reactions, recovering from exercise, blood clotting	Milk, cheese, green vegetables, bread, nuts
Potassium	Muscle reactions, - especially heart muscle, enzyme function, avoids cramps	Vegetables, fruit
Sodium	Controls water balance	Table salt, and most foods
Iodine	Regulates all bodily processes such as growth, controls rate of energy release from food	Salt water fish, fruit, vegetables
Magnesium	Stimulus transfer in muscles, aerobic and anaerobic metabolism	Nuts, fruit, pulses, green vegetables
Phosphorous	Muscle contractions, bone formation, carries fats, acid balance, cell division	Milk products, milk, vegetables, bread
Zinc	Heals wounds, protein synthesis, carbohydrate metabolism	Nuts, meat, vegetables

The minerals occur in the body in various quantities from 1 kg calcium to the milligrams of 'trace - elements'.

One of the most important minerals is iron, which is used for the transport of oxygen in the body. Athletes doing high intensity training and women in particular, because of menstrual blood loss, may experience shortage of iron in the blood.

Iron must be taken in during these periods at an increased rate along with vitamin C, which is responsible for the absorption of iron.

Zinc is used in protein synthesis and carbohydrate metabolism.

Most athletes have a shortage of zinc because a large percentage of it is absorbed by fibres and leaves the body before it can be used.

## 5.6. FIBRE OR ROUGHAGE

Fibre is an important part of the diet, but is not absorbed by the body so it is often ignored as a nutrient.

Fibre foods are natural laxatives.

They are essential in adding bulk to food as it passes through the digestive system.

Foods high in fibre are satisfying as they make you feel full without making you fat.

Natural plant foods are generally high in fibre.

Processed foods such as flour, white rice and white pastas have very little fibres.



## 5.7. FLUIDS

The average person should drink about 1 litre of water every day and another litre contained in food.

The fluid supply is essential to normal bodily functions e.g.

- The kidney uses water to eliminate urine
- The skin uses water to perspire
- The lungs use water to expire air
- The large intestines use water to remove waste products
- Fluids avoids friction between moving parts such as the eyes
- Fluids prevent the joints from wear and tear
- The blood consist of 90% water and transport the nutrients and waste material through the entire body
- Fluids help the body to store carbohydrates



Keep the following in mind when replacing fluids:

- Water and various salts contained in perspiration must be replaced.
- Drinks must be isotonic for rapid absorption
- Drinks must not be ice cold. Chilling the stomach can lead to all sorts of unpleasant problems.
- Drinks should be **sipped** at regular intervals, before, during and after competition or training.
- Drinks must have a pleasant flavour, preferably lemon, orange or lime.
- Drinks must contain readily digestible sugars to replace lost energy.
- Drinks must contain vitamin c to replace that lost through perspiration.

## 6. THE DIGESTIVE SYSTEM

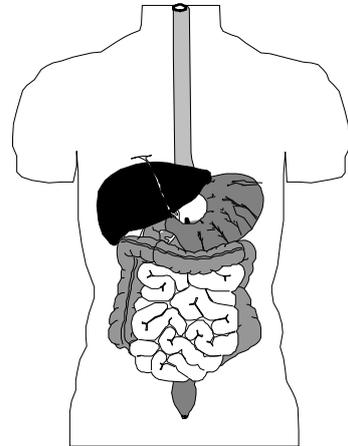
**Food takes a long time to work its way through the digestive system.**

Even if the food is well chewed, it will still consist of large chemical units that need to be broken down to smaller units to be absorbed by the body.

The digestive system will break the larger chemical units down to units small enough to be absorbed by the body.

It can take the digestive system up to 12 hours to digest food, depending on the type, size and the volume of the food.

This will have to be kept in mind when preparing for a competition or training session.



### 6.1. MOUTH

The food stays in the mouth during chewing for about 1 minute. During this time it is mixed with saliva to help with the digestion.

### 6.2. GULLET

After being swallowed, the food takes about 10-15 seconds to travel from the mouth to the stomach via the gullet.

### 6.3. STOMACH

The food stays in the stomach for 1 - 6 hours.

During this time more digestive juices are added and mixed with the food to accelerate digestion.

In the stomach all the fluids such as alcohol, sugars, water-soluble vitamins and certain drugs will pass through the wall of the stomach into the blood stream.

### 6.4. SMALL INTESTINE

During the next 6 - 12 hours the food will work its way through the stomach into the small intestine.

Here the food is absorbed into the blood

### 6.5. LARGE INTESTINE

During the next 6 - 12 hours the food will work its way through the small intestine into the large intestine.

Here all the undigested water will be stored until it is eliminated.

Very little food absorption takes place here.

All the remaining water is now also removed, leaving solid waste.

Only the fibres are not digested in this area.

The fibres make it easier for the waste to work its way out.

If too much refined carbohydrate such as white bread, sweets, cake, was taken in over a long period of time, there will be a shortage of fibres in this area.

This will cause indigestion and eventually lead to reduced performance.

### 6.6. ANUS

Once the need appears to discard of the waste, it must be done without delay to avoid discomfort and headaches.

## 7. THE BALANCED DIET

The following guidelines must be kept in mind:

- Eat lots of different kinds of food such as vegetables, fruits, fish, meat, dairy products and grains.
- Eat fresh food rather than pre- prepared, canned or frozen food.
- Eat a high proportion of carbohydrate- rich foods.
- Grill, steam or bake foods. Avoid boiling and frying.
- Avoid fatty meals and sweet or salty snacks.
- Check fibre intake by eating wholemeal breads, cereals, brown pastas and brown rice.
- Flavour foods with herbs rather than salt.
- Drink small amounts of water and fruit juices often.
- **Eat 5 to 6 small meals per day rather than 2 to 3 large ones. More frequent smaller meals will ensure a stable energy level all day long.**

### 7.1. DIET

Many books on the market can give you guidance on how to vary your diet, and how to monitor calorie intake. Here are some ideas of how attractive a simple well-balanced menu containing approximately 1 000 calories can be:

OPTION 1	OPTION 2	OPTION 3
150 gm streaky bacon 2 poached eggs 100 gm toast 25 gm butter 25 gm honey 1 cup coffee 50 ml milk 10 gm sugar	200 gm fried haddock 100 gm peas 150 gm chips Tomato ketchup 100gm canned peaches 50 gm ice-cream Coffee with milk and sugar	Soup 200 gm cold roast chicken Salad (lettuce, onion, tomato, peppers) 150 gm chips Cheese and biscuits Sweet wine Coffee with milk and sugar

### 7.2. PRE - COMPETITION NUTRITION

What you eat and when you eat prior to competition will affect your performance level during competition.

The following points should be kept in mind:

- Eat a solid meal the morning of the competition such as maize meal porridge. It is not heavy, and you will not feel hungry during the day. A hungry feeling causes you to lose concentration, and you will be emotionally unstable.
- If you eat toasted sandwiches for breakfast in the morning, you will be feeling hungry within two hours.
- The rest of the day smaller meals of not more than 500 calories at a time must be eaten, at regular intervals to ensure the energy level to remain high.
- The last meal should be 2 - 4 hours before the competition, depending on the food.
- A special liquid meal can be taken 1 - 2 hours before. The latter is preferable.
- Restrict fats and proteins since they are slowly digested.
- Avoid foods, which form gas in the digestive system such as red meat, peanuts, etc.
- Drink small amounts of water often: before, during and after competition.

### 7.3. DURING COMPETITION NUTRITION

It often happens that an athlete has to compete more than once a day e.g. in heats.

School athletes will participate in up to four events on one day, while in the decathlon it will be 5 events on one day.

It is very important that the athlete must replace the energy used during competition, within 15 minutes after the event.

After the competition, the body is in a state of emergency, trying to replace the lost energy.

Eating carbohydrates that are easily absorbable into the body soon after the event will cause the body to over-compensate and take in too much carbohydrate.

This situation decreases within 30 minutes after the competition.

Many liquid foods are available on the market.

The body will absorb a toasted sandwich with jam within 30 minutes.

A handful of peanuts and raisins is another example.

Remember to drink small quantities of fluids at regular intervals.

#### **7.4. POST-COMPETITION NUTRITION**

It is important to eat carbohydrates such as a handful of peanuts and raisins within 30 minutes after the competition. This will shorten the recovery time of the body dramatically.

In the hours and days after a major competition, lots of carbohydrates, protein, vitamins, (especially b and c) and minerals must be taken in.

Avoid animal fats for two to three days after the competition. Rather concentrate on milk, oats, wheat, yeast, eggs, liver and fish.

Taking a sauna or warm bath soon after the competition will also help with the increased intake of nutrients into the body.

### **8. NUTRITION SUPPLEMENTS**

Athletes often need supplementary nutrition, especially during prolonged periods of high intensity training or in the competition season.

Symptoms that will be experienced during these times are:

- A constant feeling of fatigue
- Becoming irritated very easily
- Having nightmares
- Having trouble to fall asleep even when feeling tired
- Getting up tired in the morning
- Frequent symptoms of flue

Female athletes will experience these symptoms more frequently than the men due to their menstrual cycle.

There are many products available on the market today that are effective. The following guidelines must be kept in mind when using them:

- Take limited amounts of the fat-soluble vitamins (A, D, E and K). Excess vitamins in this group get caught up in the body fat and become toxic to the body, leading to a decreased performance level.
- Vitamin C supplements must be taken regularly. Vitamin C does not become toxic and up to 1000 mg per day can be taken without any risk attached. All athletes have a chronic shortage of vitamin C during periods of high intensity training. Oranges lose almost all their vitamin C contents within 10 days after being picked from the tree and should be eaten for the fibre content rather than the vitamin C content.

- Vitamin B complex must be taken regularly. As seen from the vitamin table, all the B vitamins play a very important role. They are not toxic and can be taken over long periods.
- Mineral intake can also be increased with the emphasis on iron, calcium, magnesium and zinc. Mineral intake cannot be taken in over long periods of time, because it also becomes toxic to the body. The quantity per unit must be limited. Short periods of no mineral intake are also important to allow the body to cleanse itself.
- The pigmentation of vegetables is a natural cleansing substance and raw vegetables should be eaten regularly.
- Finally, vitamin and mineral supplements can be a costly exercise. The following can be done to reduce the cost:
  - Eat peanuts and raisins after every training session. It will speed up the recovery rate.
  - Yeast pills are very cheap. Up to six pills can be taken daily. They contain among others, large volumes of the vitamin b complex.
  - Dolomite pills are very cheap and contain large quantities of magnesium and calcium among other minerals.
  - Parsley contains large volumes of vitamin C, even when dried. Eat it with every meal.

## 9. BIBLIOGRAPHY

- 9.1. Coaching Theory Manual, British Athletic Federation, 225a Bristol Rd, Birmingham B5 7UB
- 9.2. Introduction To Coaching Theory - I.A.A.F., 3 Hans Crescent, Knightsbridge, London SW1X, England.
- 9.3. Sports Medicine, Dr I. Cohen, Prof. G Beaton, Prof. D. Mitchell - Sports Medicine Clinic, Campus Health Service, University Of Witwatersrand, Johannesburg, 2000, S.A.
- 9.4. Training Theory, Frank Dick - British Athletic Federation, Edgbaston House, 3 Duchess Place, Birmingham B16 8NM