**Nutrition and Hydration .**

Let us start with a few anecdotes and general observations on nutrition. An alien expedition party, having been sent to earth to study the creatures who dwelt there , reported back to the mother-ship. “ These earthlings are basically just bags of water” they said. “Then”, said their Great Leader , “ this substance must be very important to them and I presume they consume vast quantities of it”.

The late Laro Byrne ( not to be confused with aliens- even though he did come from Wicklow ) always advised us to eat well : “ You don’t put low grade fuel in a Formula 1 car”, he used to say “ And you don’t put junk food into an athlete”.

Paddy Marley tells a lovely story about the same Laro Byrne taking care of himself and Danny McDaid and their nutritional requirements. Paddy and Danny shared a flat in the year prior to the Munich Olympics and were regularly clocking 100+ miles per week .One night , Laro arrived at their flat with a huge crate of Guinness with strict instructions to drink one bottle -and no more – of the famous Liffey water each night. “ And that’s what we did” , recounts Paddy ; “ we never exceeded one bottle per night ; we wouldn’t dream of disobeying Laro’s orders”. The wily Laro was very aware that Guinness has a high percentage of Brewer’s Yeast which, in turn , is rich in Vitamin B which is very instrumental in supplying our energy needs.

Remember that your daily running is only a part of your daily training. Your **entire lifestyle** will have a crucial bearing on how you perform in competition . Therefore you must ensure that you’re getting adequate rest, sleep, nutrition and hydration . They are all part of the simple “jig-saw” which goes to making up the complete runner .

We are probably aware of the fact that a balanced diet consists of approx. 60-65% Carbohydrate, approx.20-25% Fat and approx.10- 15% Protein. According to most reputable nutritionists and dieticians these ratios have not changed, in spite of the plethora of fad diets and “wonder diets” which so-called star personalities tout with monotonous regularity. Dr. Ciara Kelly M.D. referred to this recently on Newstalk as “Nutri-babble”. Several studies carried out by dieticians appointed by the Irish Olympic Council have shown , time and time again, that most of our top athletes still eat too much fat and not enough carbohydrate.

The legendary Bob Tisdall\* was interviewed on Irish radio about 15 years ago. Tisdall, who was then well into his 90s, was asked to what did he ascribe his longevity , great health and fitness. The ram-rod straight Tisdall replied “ You must put proper fuel into your body”. He followed this by saying “ People don’t chew their food anymore – use your teeth !” A voice from an era when junk foods and American style “grazing” were unknown. In addition to popular carbohydrates such as wholemeal bread, porridge, muesli, potatoes, pasta and spaghetti, athletes should eat more **complex carbohydrates** such as fruit and vegetables. The complex carbohydrates release their energy more slowly and have a longer lasting effect. We are all aware of the need for a good breakfast ( “the most important meal of the day” ) yet many people , in their rush to work, have nothing only a cup of coffee before embarking on their day.

Athletes should try to include some of the complex carbohydrates in every meal : e.g. a chopped banana with their breakfast muesli or porridge, substituting an apple or orange for the traditional cup of tea or coffee at “elevenses”, bringing a few bananas to eat immediately after training ,etc. We all know ( and this was reiterated again in an earlier piece in this series of coaching articles ) that carbohydrate ingested within 90 minutes of completion of training has a most beneficial effect on glycogen replacement.  *( cf. “ Recovery Post Session and Post Race” )*

*\* It should not be necessary to say who Bob Tisdall is . But, sadly, younger readers may not have heard of him. He, of course, won the Olympic 400m.Hurdles for Ireland in the 1932 Olympic Games . He was the first man to break 52 seconds for the 400m.Hurdles, setting a World Record of 51.7 when winning the Gold in Los Angeles. He passed away in 2004 at the age of 97.*

Before starting this piece on nutrition and hydration , let us also remember the golden rule “ Moderation in everything” and let’s hear the words of Laro Byrne once more “ A little of what you fancy every now and again will do you no harm”. And finally ,let me repeat once more this warning : Beware of fads and fallacies which the many quacks and charlatans try to foist on us for commercial gain for themselves. Now let us look at the three basic chemical groups in which food can be categorised.

**Carbohydrates ( CH0 ) :**  carbohydrates ( also known as saccharides ) are compounds of carbon , hydrogen and oxygen , the ratio between the last two being 2:1 ( like in water ). I do not intend to make this article overly complicated or academic by discussing the differences between monosaccharides, disaccharides ,oligosaccharides and polysaccharides.

 Carbohydrates provide the body with glucose which is converted to energy , used to support bodily functions and physical activity. Carbohydrates perform numerous roles in living organisms . They are our main source of energy and provide nutrients for good health and a balanced diet. Our bodies rely on carbohydrates for a quick supply of energy . They also play a crucial role in the proper functioning of the immune system , fertilization ,blood clotting and human development .Excessive consumption of carbohydrates, however, especially refined carbos like sugar, can lead to obesity , type 2 diabetes and cancer. Unhealthy high carbohydrate foods include sugary cereals , refined white flour , biscuits , bread products , jams , preserves, refined potato products and sugary drinks . Healthy high carbohydrate foods include vegetables, ( especially green leafy vegetables ), legumes ( beans), chickpeas, whole grains, rice, potatoes, sweet potatoes, fruits , nuts, pasta, spaghetti, low fat milk and yoghurt .

While fats and protein can be used as energy sources , the body prefers the use of carbohydrates, especially during exercise , because of their more efficient metabolism .They are an instant source of energy and can be stored in the form of glycogen in both muscles and in the liver .The amount of glycogen that we can store ,however, is relatively small: about 2,500 calories. Marathon runners will be particularly familiar with what happens when they have exhausted their supply of glycogen and have to switch to metabolising fat as an energy source during the closing stages of a marathon ; unless they are efficient “fat burners” the transition can be painful. Incidentally , women are much more effective “fat burners” than men . The point at which marathon runners exhausted their supply of glycogen has become known ,of course , as “ hitting the wall” ; highly trained elite runners, however, rarely hit this wall and the sagacious use of drinks and gels can help in eliminating this painful process.

Strangely, perhaps, carbohydrates are not an essential source of energy – but they are the quickest and the cheapest. Any runner or cyclist (especially the cyclist) who hits the wall or “gets the knock” as cyclists say , know the intense craving for a quick “fix” of something sweet and sugary to boost their blood sugar levels : in such cases they often resort to the very carbos which , normally , they would avoid, such as chocolate bars and sugary drinks ! It is possible, at least in theory, for the body to function without carbohydrates and this is why some modern, fad diets recommend a regime of fats and proteins only as a means of losing weight. But such a diet is essentially unbalanced and would be totally unsuitable for the distance runner who burns off carbs. at a monumental rate. The potential for some negative health effects of extreme carbohydrate restriction remains , although the issue has not been extensively studied.

Training for competitive sports may increase one’s daily energy expenditure by 25-50 %. Athletes who run 16-24 Km. per day ( 10-15 miles) have an average expenditure of 55-65 kcal/km. ( Jang et al.1987 ). According to the Olympic Book of Sports Medicine, athletes running this sort of volume expend 900- 2400 k/cal/day  **on training alone .** The calorie requirement even for people in sedentary jobs is approx. 2000 per day for females and 2400 per day for males ( this varies according to age and is greatest for adults between the ages of 19 and 30 years.) So, as the Americans would say, “ Do the Math.” ! If you don’t like doing the calculations , it has been estimated that the total energy expenditure for athletes in heavy training may range from 47-85 kcal/kg.of bodyweight/day. ( Dengel et al.1987 ) A 65 kg .athlete ,therefore, would have a daily energy expenditure of 3055-5525 kcal. While fats and protein contribute to the energy pool during exercise , these fuels alone cannot support the demands of acute exercise. Carbohydrate is the primary fuel for exercise. Even in a marathon race less than 1% of the body’s total fat and protein stores might be oxidised , whereas total glycogen depletion may occur . ( Some would say “ will definitely occur” ). Glycogen is essential even for sprinters as the production of ATP ( adenosine triphosphate ) during intense , explosive exercise depends on the availability of muscle glycogen and blood glucose. At the onset of exercise , muscle glycogen is the primary source of carbohydrate used for energy . The rate of glycogen used from the gastrocnemius ( “calf” ) muscle is greatest during the first 90 minutes of running. This emphasises the need for restraint in the early stages of long distance races , especially the marathon, and also the need to have the muscles well topped up with glycogen before racing. The higher the initial muscle glycogen stores, the longer the athlete can continue to exercise at a given load ( > 70% Vo2 max. ) . The importance of a rich carbohydrate diet in the days that precede an endurance event is well established ( what most marathon runners call “ carbo loading” ). It is obvious, therefore, that carbohydrate intake is vitally important for all athletes. At this point it might be appropriate to say a few words about carbo-loading . Studies conducted in the late 1960s demonstrated that exercise -diet manipulation could double the muscle glycogen stores . As far back as 1939 , E.H. Christensen and O.Hansen observed that men on a high CHO diet performed heavy work loads for more than twice as long as men on a high fat diet . Based on studies by J.Bergstrom and E.Hultman (1967), P.O.Astrand ( 1967)proposed that the optimal plan to achieve maximal glycogen storage ( glycogen loading ) in preparation for endurance competition would be to perform an exhaustive training session 1 week before competition ( i.e. depletion exercise -usually a fairly brisk 20 mile run ) ,followed by 3 days on a diet rich in fat and protein . This kept glycogen levels low and became known as the “bleed-out” phase . Thereafter the athlete consumed a high carbohydrate diet for the final days leading up to competition. The intensity and volume of training during this week long phase should be reduced to prevent additional glycogen consumption and to permit maximal glycogen storage. This became popular with marathon runners like Ron Hill in the late 60s and early 70s with varying degrees of success. Most runners complained of feeling rather weak and irritable during the “ bleed -out” phase. ( “ I was growing hair on the palms of my hands and howling at the moon” was the colourful way one athlete described how he felt during these 3-4 days !). This was due to the fact that they had become hypoglycaemic ( very low blood sugar levels ). Consequently , Sherman et al. ( 1981 ) studied a less drastic diet routine . They observed that when a mixed diet was used for 3 days instead of the low CHO phase of the regime, muscle glycogen achieved the same high levels as described by Astrand. So it now appears that neither the glycogen depletion exercise nor the bleed out phase of a very low CHO diet are necessary for the maximal glycogen storage. Various recent studies have shown that athletes are able to achieve maximal muscle glycogen levels simply by resting for 2-3 days while eating a diet rich in CHO. **N.B.** It is very important to note that because approx.2.6g. of water is stored with each gramme of glycogen, CHO loading often produces a 1-2 Kg. increase in body weight . This is why runners often experience a certain feeling of “sluggishness” in the early stages of a marathon.

So, to sum up with a few pieces of practical advice : Carbohydrates consumed in food yields 3.87 calories of energy per gram for simple sugars and 3.57 to 4.12 calories per gram for complex carbohydrates.  **Remember that the really important thing is the type of carbohydrates in your diet because** **some sources are healthier than others.**  For example, whole wheat bread is better than refined white bread , quinoa is better than French fries. The healthiest sources of carbohydrates are unprocessed ( or minimally processed), whole grains , vegetables, fruits and beans. The unhealthiest sources include white bread , pastries, soft drinks and other processed or refined foods. It is often recommended, as a rule of thumb, that you should fill most of your dinner plate with healthy carbohydrates, with vegetables and fruits taking up about half the plate , whole grains filling about an eighth, with protein ( e.g. beans or chickpeas ) and fats ( meat ) taking up the other three-eights.

Start the day with porridge or a cereal that lists a whole grain first on the ingredient list and is low in sugar. Another rule of thumb : choose a cereal that has at least 4 grammes of fibre and less than 8 grammes of sugar per serving. Wheat-germ sprinkled on your cereal can provide a rich source of vitamin B2 which plays an essential role in carbohydrate metabolism. Also choose whole fruit instead of juice. A whole orange has twice as much fibre and half as much sugar as a glass of orange juice which you may have purchased in a store .

**Fats** : Fats consist of two types : saturated and unsaturated. All fats are high in calories , so it’s important to bear this in mind if you’re watching your weight. Fats, like carbohydrates , contain carbon, hydrogen and oxygen. The hydrogen to oxygen ratio is no longer 2:1 as this factor varies according to the degree of “saturation” . Fats have a relatively low oxygen content , hence they have high energy potential. As far as sport is concerned, however , they are inefficient because of their greater oxygen usage in the metabolic process. Fats do form the greatest store of energy within the body.The body of an average young man is composed of approx.16% fat , which has a potential energy yield of 100,000 Calories ! This would be sufficient to last a sedentary person for several months. The fats which we eat can be derived from both animal and vegetable sources . Those of plant origin are said to be “unsaturated” while the “saturated” variety come from an animal source. We should try to eat foods that contain healthy monounsaturated and polyunsaturated fats. We need a minimum amount of fatty acids to enable the kidneys and skin to function properly and to transport the fat-soluble vitamins ( A,D,E,K ). They also have an intricate function in maintaining a homeostatic state in our hormones. Fat also has a thermo-insulatory effect , it provides protection for our organs and has a cosmetic function. So while fat is absolutely essential for good health, it is estimated that in the developed Western ( First ) World we generally consume 50% more fat than is required . This, of course , can have a detrimental effect on health especially when a diet consists of excessive fats derived from animals . ( “ But they are so appetising and tasty !” ) . It is estimated that the average man should have no more than 30g. of saturated fat per day and the average woman no more than 20g. per day . There is ,however, an ongoing debate about recommendations for the intake of saturated fats , especially in reference to egg and dairy products. ( It is also difficult to define “average” in this context.

**Protein :**  proteins are nitrogen containing compounds formed by amino acids . Like carbohydrates and fats they also contain carbon, hydrogen and oxygen. But they are the body’s only source of nitrogen and hence they are a prerequisite of life. They constitute the major structural component of the cell, antibodies, enzymes and many hormones. Protein is necessary for growth , but it is also necessary for the repair and maintenance of body tissues. It is necessary for the production of haemoglobin ( iron + protein ) ,the production of enzymes, hormones, the maintenance of normal osmotic balance and protection from disease through antibodies. Proteins are also potential sources of energy but they are generally spared when fat and carbohydrate are in ample supply. Protein sources in the diet that contain all of the essential amino acids in the proper ratio and in sufficient quantity are referred to as complete proteins. Meat ,fish and poultry are the three primary complete proteins. The proteins in vegetables and grains are referred to as incomplete proteins , as they do not supply all of the essential amino acids in appropriate amounts. Approximately 15% of the total calories consumed per day by athletes in hard training should be in the form of protein ( the requirements of sedentary people or people who take only mild exercise are considerably less ). While the recommended daily allowance published by the US National Research Council is only 0.8g/kg. bodyweight, various studies have shown that athletes in hard training need considerably more. In her comprehensive review, E.M.Haymes ( 1983 ) has concluded that a protein intake of even 1g./kg. bodyweight may be inadequate for diets of athletes in training. Increased protein intake seems to be particularly important in the early stages of training to support increases in muscle mass , myoglobin and enzyme content. The optimal intake during this period would appear to be approx. 1.2 g./kg. bodyweight per day but for athletes involved in explosive strength training ( e.g. throwers) the optimal intake may be as high as 2.0g./kg. bodyweight/per day. ( In “old money “, this approximated to your body weight in lbs. multiplied by 0.36. ). Undoubtedly, athletes in hard training need extra protein. The reason for this is that amino acids are broken down for energy in exercising muscles. So proteins are burned as well as carbs. and fats to supply us with energy. Generally only 5% of energy comes from protein breakdown but this can increase to 10 or even 15% when glycogen stores are drained during exercise lasting 2 or more hours. In effect ,you may be breaking down muscle during hard training sessions which, of course, will need rebuilding during recovery. Extra protein ,however, cannot be stored for later use : your body must use, transform or discard protein on the spot. If it gets more than it needs the extra protein is broken down and stored as fat . Overdoing protein intake can lead to a loss of calcium through the urine which can lead to osteoporosis in later life. It can also make the kidneys work overtime, resulting in dehydration. It can also lead to high cholesterol levels. As far back as 1955 , the united Nations Committee for food and agriculture rated the most common sources of protein in rank order. Eggs were found to contain the best balance of “essential” amino acids and were given a 100% rating. The other foods were rated **in comparison to eggs** as follows: Fish\*/Meat : 70%; Soya beans : 69% ; Milk 60%; Rice 56 % ; Corn 41 % . (\* Tuna is one of the richest sources of protein as well as being a great provider of B vitamins.)

**Remember that the delicate nitrogen balance of the body must be maintained and the dietary** **intakes must allow for this. We have also seen in an earlier article  *( Recovery Post Race/Post Workout )*  that the ingestion of protein, as well as carbohydrate, within 30 minutes of finishing a race or tough workout is vitally important.**

**Vitamins :**  It is almost impossible to define what precisely vitamins are .But we can regard them as the catalyst of nutritional chemistry. They speed up or make more efficient, the digestive process which converts food into substances which can be used directly in the metabolic process. Basically they can be divided into two groups : fat soluble , those which occur and dissolve in fat ( A,D,E,and K) and those which dissolve in water ( B and C groups ) . Athletes are always looking for an edge, something that will give them an advantage .Manipulating the diet and taking extra quantities of various vitamins and minerals seem to be relatively harmless methods to make the body work at its best . But do these really help ? There have been a number of studies that found increased endurance with megadoses of vitamins C,E and B-complex, but there are far more studies demonstrating that vitamin intake in excess of the RDA ( recommended daily allowance ) will not improve performance in endurance activities.  **It is safe to say that popping vitamins will not make up for a lack of talent or training or give one an edge over the competition .** As a matter of fact, too much of a good thing can be harmful. Extremely large doses of vitamins A and D may produce undesirable effects .Overdoses of vitamin A, for example, may cause a loss of appetite , enlargement of liver and spleen ,swelling of the long bones and general irritability . The RDA values seem to be optimal for normal body operations, though possibly on the conservative side. Let us look at each vitamin in a little more detail : **Vitamin A :** Vitamin A can be taken directly into the body through one of the fish liver oils or indirectly via the carotene in vegetables or fruit . This substance is converted into vitamin A in the intestine and is stored in the liver. For this conversion to take place vitamin E must be present , so illustrating the interdependence of vitamins upon each other. Vitamin A is essential for the well being of all epithelial tissue ( this type of tissue lines the cavities and surfaces of blood vessels and organs throughout the body ; the other types of tissue are connective tissue , muscle tissue and nervous tissue ).Unless the diet is very low in fats it is most unlikely that the body will be deficient in this vitamin. It should also be noted that large doses of vitamin A are toxic.  **Vitamin B:** This is a ”complex” of vitamins all related to each other in certain ways . As they are water solublethey cannot be stored in the body , hence the need for a daily intake . **Vitamin B1 ( Thiamin ) :** This is present in wheat-germ which, unfortunately, can be destroyed in the refining process of most flour. It plays an essential role in carbohydrate metabolism , acting as a coenzyme for the oxidisation of pyruvic acid . **Vitamin B2( Riboflavin ) :** Again, one of the richest sources of this vitamin is wheat-germ and another is yeast ( Hence, Laro Byrne’s faith in Guinness ).It has a similar effect to that of B1 in the oxidisation of carbohydrates . **Vitamin B3 ( Niacin ) :**  this vitamin , which is also known as nicotinic acid, is present in yeast associations , fish ,nuts and meat. It helps to form enzymes which aid the assimilation of carbohydrates and is a necessary catalyst for the functioning of vitamins B1 and B2. **Vitamin B6 : ( Pyridoxine ) :** The sources of this vitamin are identical to those of the vitamins in this group already mentioned . It is essential for the correct action of vitamins B1 and B2 as well as playing an important role in the nitrogen balance of the body. **Vitamin B12 ( Folate ):**  this is the only member of the vitamin B complex not found in yeast products. Meat and dairy products, however, have a high yield. A lack of vitamin B12 can lead to anaemia . People who are vegans ,vegetarians and those who eat gluten -free may need to take a B12 supplement to avoid malnutrition and anaemia. It is one of the most important vitamins which we need for our nervous system and energy levels. It occurs naturally in meat, eggs and fish. B12 helps your body produce red blood cells and every distance runner knows just how important they are . You will feel fatigued if you don’t get enough B12 in your diet ( just as you will if you don’t get enough iron and fat ). Very often nowadays when people feel lacking in energy they reach for a cup of coffee or an energy drink when they really should be trying to ensure that they are getting an adequate intake of vitamin B12. This vitamin also helps with he body’s stress responses and helps regulate the nervous system . Studies have shown that B12 can help prevent and treat depression. The richest sources of B12 are liver, mackerel, sardines, red meat , fortified cereals, salmon, milk Swiss cheese, yoghurt and fortified soya. **Choline :**  another member of the B complex ,it is present in most of the foods already mentioned . Its precise action is difficult to define but its presence is essential for the total action of the Vitamin B group. It is thought to have a positive effect on the digestion ,transportation and deposition of fats. **Vitamin C :**  This vitamin is available in all forms of citrus fruits and most fresh ,green vegetables. It is thought to have a beneficial effect in preventing viral infections such as the common cold. It is closely associated with the absorption of iron ,an essential pigment for the transportation of oxygen, and directly for the carrying of hydrogen. It is also necessary for the health of all connective tissues including cartilage, ligaments and veins. Cooking, storing and preserving food can considerably reduce the levels of vitamin C. **Vitamin D:** This is a group composed mainly of Vitamin D2, which comes from a vegetable source and is sometimes called the “Sunshine Vitamin”, and Vitamin D3 which comes from an animal source. Its main function in health is to aid the production of strong bones and teeth. Fish oils are probably the best source of Vitamin D. **Vitamin E :** This vitamin is known to exist in several forms and has an effect upon the body’s store of vitamins A and C , mainly through its action on the digestive tract and upon the well-being of skeletal muscle tissue. Vitamin E is present in most seed oils. There are other vitamins such as Vitamin K, which is said to have an effect on blood and blood vessels, and Vitamin P , the bioflavonoids which are similar to vitamin C.  **Selenium :** Selenium works with Vitamin E to protect against free-radical attack. The main sources of selenium are meat and seafood. Selenium supplements are not recommended as even as little as 2-3 times above the RDA can be toxic. **While a number of studies have found increased endurance with megadoses of vitamins C,E and B-complex, there are far more studies demonstrating that vitamin intake in excess of the RDA will not improve performance in either strength, explosive or endurance events Experts generally agree that popping vitamin pills will not make up for a lack of talent or training or give one an edge over the opposition.**

**Minerals:** People sometimes confuse the presence and action of minerals with those of vitamins. While theirtotal effect upon healthy life might be similar, their action is completely different. Basically the mineral action in the body can be divided into two groups: those minerals which are essential for the delicate fluid/salt balance , including sodium, potassium and chloride; and other essential minerals which include calcium, phosphor, magnesium zinc and iron. **Calcium**  is essential for bone structure and its presence is necessary for the correct rhythmical function of cardiac and associated circulatory tissue. Calcium can be stored in the body, particularly in the gut. The main sources of this mineral are dairy products and green vegetables. We have about 2lbs.( .907 Kg.) .of calcium in our bodies and require 1gramme daily. Sufficient calcium throughout life is the best protection against osteoporosis which is very common in women over the age of 55.After the age of 35, in fact, our bones start to lose calcium and they become weaker and more susceptible to fracture . **Phosphor,** together with magnesia, is essential for the correct functioning of nervous and muscle tissue. **Magnesium** combineswith both calcium and phosphor in the growth and repair of bone tissue. **Zinc**  is an essential element in insulin and in the enzymes which aid protein synthesis . **Iron :** This ,of course, is an essential mineral as you simply cannot compete well ( if at all ) if you are anaemic or even mildly so. Iron is an essential component of haemoglobin ,the oxygen-carrying component of blood ,and of myoglobin ,the oxygen-transporting pigment of muscle. Anaemia ,brought on by iron depletion, is more common in runners than in the general population. Reasons range from blood loss in the urine to increased breakdown of red cells due to foot pounding as well as the most obvious : poor dietary intake. Haemoglobin levels should be >13g.per decilitre in men and > 12g.per decilitre in women. Since iron-deficiency anaemia is known to impair endurance performance, it is important to distinguish between true anaemia and the plasma volume dilution associated with repeated days of training in warm weather .Training tends to increase the volume of plasma more than the number of red blood cells ,producing a drop in haemoglobin concentration with no apparent effect on oxygen transport or endurance. Plasma water changes dramatically with both acute and chronic exercise , whereas the number of red cells remains relatively constant. Thus, changes in plasma volume can alter the concentration of red blood cells and haemoglobin, giving the false impression of anaemia. Several studies ,however, have shown that between 36 and 82% of female athletes are anaemic or iron deficient. In light of this it seems logical that they should include iron-rich foods in their diets. In addition to getting their haemoglobin levels tested, athletes should ask their doctor to test their serum ferritin, which is a measure of the body’s iron stores. Your haemoglobin levels might be fine but if your ferritin levels are low then you can expect to become anaemic before too long. Iron supplementation should, however, be directed by a physician ,since prolonged administration of iron can cause an iron overload, a potentially serious condition.  *( Haematomachrosis-“The Irish Disease”- was referred to in an earlier article ).* While supplemental iron will boost sagging iron stores and alleviate anaemia ,you should not think of iron as a preventative measure. Iron supplements contain anything from 30 to 200mg. which is way above the RDA of 10mg.for men and 15mg.for women. Excessive iron also inhibits the absorption of zinc. The right foods will enable you to meet your iron requirements quite easily. The best form of dietary iron is ***heme iron***  found in red meats ,poultry and fish. Tea ,coffee and red wine contain tannins which bind iron and decrease its absorption by 40-90% and so should be consumed in moderation. ( These drinks, of course , are also diuretics, which means they lead to increased urination ). Vitamin C enhances the absorption of iron ; having a glass of pure orange juice with your morning cereal can boost your iron utilisation. More and more people are asking “ Is meat okay?”. So, let’s look at a few basic facts about meat. Meat offers outstanding nutritional value , being loaded with proteins ,vitamins and minerals .But it can also be loaded with cholesterol and fat. (You can avoid the worst of this by trimming the fat before cooking). Generally speaking , people are being recommended to eat more white meat (poultry ) and fish .This is a healthy development but athletes should not eliminate red meat completely from their diets- indeed a helping of liver at least once a week is still a tried and trusted means of ensuring that you do not become anaemic and that your haemoglobin and ferritin levels are kept at optimum levels.

In addition to these minerals, there are other trace elements which are essential to good health. These include chromium, nickel, tin, vanadium, silicon and fluoride. Their precise action is not yet fully understood.

**Water: Arguably, this is the most important nutrient of all and perhaps I should have started here.** Remembering what our friends the aliens said about human beings simply “bags of water” it might be worthwhile to examine the reasons why they came to this conclusion. ( Being of superior intelligence they are almost certainly right ).  **Up to 65% of the human adult body is water.** The brain and heart are composed of approx.73% water and the lungs are about 83% water. (The percentages vary according to your age, gender and fitness but are generally about the figures outlined). Therefore it seems rather obvious that water is an essential element, indeed the most essential, for life and health. A human can go for more than three weeks without food but the maximum time an individual can go without water is at most a week but, in certain conditions such as broiling heat, a lot shorter. Indeed 3-4 days would appear to be more typical. Every living cell in the body needs water to keep it functioning. Water acts as a lubricant for our joints, regulates our body temperature through sweating and respiration and helps to flush away waste through perspiration ,urination and defecation. It forms saliva which aids digestion. It is needed by the brain to manufacture hormones and neurotransmitters. It acts as a shock absorber for the brain and spinal cord. It converts food to components needed for survival. It helps deliver oxygen all over the body. Our bodies use water in all our cells ,organs and tissues to help regulate its temperature and maintain other bodily functions. Because our bodies loses water through breathing, sweating and digestion ,it’s vitally important to rehydrate by drinking fluids and eating foods that contain water . Staying well hydrated is particularly important for middle and long-distance runners. If you become dehydrated your blood volume decreases ,so less blood returns to your heart . Therefore the amount of blood which your heart pumps with each stroke decreases. This means that less oxygen enriched blood is now reaching the working muscles so you are now producing less energy aerobically .The end result of all this is ,of course, you slow down. Digestion starts with saliva ,the basis of which is water. Digestion relies on enzymes which are found in saliva to help break down food and liquid and to dissolve minerals and other nutrients. Water is also necessary to help you digest soluble fibre. With the help of water the fibre dissolves easily and benefits your bowel health. Your body loses fluid when you exercise vigorously, sweat in high heat or come down with a fever or contract an illness which causes vomiting or diarrhoea. If you’re losing fluid for any of these reasons it’s important to increase your fluid intake so that you can restore your body’s natural hydration levels. **How much water do we need ?** There is no hard and fast rule and many individuals meet their daily hydration needs by simply drinking water when they feel thirsty and by having a beverage with each of their meals. There is a long standing medical rule of thumb which says we should drink eight 8-ounce glasses per day . This equals approx. 2 litres or half a gallon ( 4 pints.). This is called the 8 X 8 Rule and is very easy to remember. Marathon runners, however, know that if they leave drinking until they feel thirsty, it’s too late . It’s very easy to know if you’re dehydrated: just examine your urine . If it’s clear, you’re fine; if it’s dark, you’re probably dehydrated. Ironically, runners tend to become dehydrated more often in Winter , possibly because the need to drink isn’t as obvious. A good rule of thumb for athletes is to drink about 50 ml.per kilogram of body weight throughout the day . At very warm or hot temperatures, you should drink 1 or 2 litres more per day.  **Athletes should hydrate , before , during and after exercise .** The amount of sweat lost during exercise depends on the exercise intensity , body size, ambient temperature and environmental heat stress .Exercising in warm weather may evoke sweat losses in excess of 2 litres per hour. Despite efforts to drink fluids during an event such as the marathon, sweating and the loss of water in the air breathed may reduce body water content by 13-14 % . *( The Olympic Book of Sports Medicine ).* Studies have shown that distance runners are forced to slow their pace by 2% for each percent ofbody weight lost as a consequence of dehydration. Both heart rate and body temperature are elevated during exercise when the individual is dehydrated by more than 2% of bodyweight. The impact of dehydration on the cardiovascular system is well known. Plasma volume is lost and the ability to provide adequate blood flow to the skin and muscles is reduced. Under such circumstances, it is common for athletes to collapse showing the usual symptoms of heat exhaustion. Humans are completely unable to exercise if they are dehydrated by more than 10% and death in humans occurs at dehydration levels of 20% or greater. Tim Noakes, in his seminal work, ***Lore of Running,*** gives us a number of formulae for calculating sweat rate and percentage dehydration . According to Noakes, Sweat rate ( in litres per hour ) = \* WB-WA / Running time (in hours). \*WB =weight before racing , WA = weight after racing (in Kg.) His formula for calculating percentage dehydration is : (WB-WA ) X100 / WB. Noakes claims that your fluid replacement has been adequate if, after races longer than 30K., your weight loss has been no more than 2-3 Kg. and you have been dehydrated by no more than 3%. Human sweat has been described as a “filtrate of plasma”, since it contains many of the items present in the water portion of blood, including sodium , chloride, potassium ,magnesium and calcium. However, even though sweat tastes salty , it actually contains far fewer minerals than do body fluids. During exercise blood flow to the kidneys decreases and urine production drops to near zero. Consequently, electrolyte losses by this avenue are quite diminished during exercise. Heavy sweating and dehydration cause the release of aldosterone, a hormone from the adrenal gland that stimulates the kidneys to reabsorb sodium and chloride. Since the body loses more water than electrolytes during heavy sweating , the concentration of these minerals in the body fluids rises. This means that, instead of showing a drop in plasma electrolyte concentrations, there is actually an increase. So ,during exercise , it is far more important to replace body water than to replace electrolytes. A large number of sports drinks are currently on the market ; many of the claims used to sell these drinks are based on misinterpreted and often inaccurate information. A single meal can usually replace the electrolytes during exercise. However, the advantage of replacement drinks with up to 8% carbohydrate is that they’re absorbed as quickly as water and provide readily usable energy .The concentration of CHO will depend on your stomach’s tolerance and on how warm the conditions are . Authorities such as David Costill would argue that the concentration of CHO should not exceed 2.5% but the athlete can only determine what exactly suits himself or herself by experimenting with various drinks during training. Like everything else, you DO NOT experiment in a race ! **Alcohol and Caffeine :** Most running magazines tell you to avoid alcohol and caffeine. This is neither realistic nor helpful. The real issue is how much of these beverage scan you drink before they have a significant effect on your performance. Alcohol primarily affects your brain. One or two drinks temporarily lead to reduced tension and relief from stress but can also cause dehydration. You should drink an extra ounce of water for every ounce of beer and an extra 3 fluid ounces ( 1 fluid ounce =29.6 ml.)of water for every glass of wine. Quite a few legendary Clonliffe Harriers liked to take a drink on the night before a race as they believed it helped to relax them and led to better sleep.(Niall Bruton had two pints of beer the night before he won the World Students’ Games 1500m.title in 1991 and Jerry Kiernan had a bottle of Bud the evening before his superb run in the 1984 Olympic marathon. The late Pádraig Keane always had two pints of Guinness before the national Senior C.C. Championships : they certainly did not prevent him from having many, many great runs and making the Irish team for the World Cross on numerous occasions.) The IOC considers caffeine a banned drug but the maximum allowable limit in the urine has been set so high that you would need to drink about 8 cups of percolated coffee to fail a drug test. Several studies have found performance enhancing effects from caffeine ingestion, several others have found no effect of caffeine ingestion on endurance performance while at least one study found caffeine ingestion to be related to reduced performance. The two effects of caffeine that may boost performance, especially for marathoners, are a glycogen-sparing effect and its effect as a central nervous system stimulant. Ingesting caffeine mobilises fatty acids that allow you to use more fat and less glycogen at a given pace, meaning that your glycogen stores last longer. In theory , caffeine ingestion could allow your glycogen stores to last the full marathon distance. As a central nervous system stimulant, caffeine increases arousal. This would seem to be more beneficial to sprinters than to marathon runners, who need to stay calmly focused during the event .Caffeine also has a “rebound” effect about two hours after ingestion ; this is the very time you will be feeling pretty fatigued anyway during a marathon so you don’t want to experience this double whammy. Unless you have practised taking coffee before your longest training runs , the risk of a negative impact on performance is too great to warrant taking caffeine ( except, perhaps, one cup ) before the marathon.

 The body needs water above all to bring its concentration of the electrolytes back into balance. While the importance of minerals such as sodium , potassium and magnesium should not be underestimated , blood and muscle biopsy studies have shown that heavy sweating has little or no effect on water and electrolyte concentrations in body fluids during endurance events. Even marathon runners, who lose 2.5-4 Kg. of sweat but drink nearly 2 litres of water ,retain normal plasma sodium, chloride and potassium concentrations. Laro Byrne ( Irish Olympic Team Coach in 1984 ) always claimed that marathon runners only needed to drink water, preferably distilled; the great Dick Hooper drank cold tea during his many superb marathon races ( he did this because a number of studies have shown that cold tea facilitates the metabolization of fats ). Water empties from the stomach with minimal delay ,is easy to obtain and reduces the dehydration associated with heavy sweating. In cooler conditions , a carbohydrate will provide the energy lift needed for peak performance in events lasting an hour or longer . In events lasting less than an hour ,there is less need for water ingestion and little benefit from the intake of carbohydrates.

**Dietary fibre.**

As well as nutrients ,which are absorbed through our digestive system, the diet should also **contain** plant material which is not digested or absorbed in any way from the intestine. This vegetable material is often known as roughage. Its action seems to be twofold : fibres can absorb bile acids which are necessary for digestion but can ultimately have a bad effect upon the health of the intestine ,particularly on cholesterol metabolism. The same fibres considerably increase the water content of the stool, so acting as a diluent of materials in the colon which are likely to have an adverse side-effect on the surrounding tissue composing the lower end of the digestive tract. It is a well established fact that the incidence of illnesses in the lower intestine is considerably less in countries where the diet contains a high percentage of vegetable fibre. There are many different types of fibre but there are two main groups : soluble and insoluble. Each group helps your body in different ways , so it is important to include both in your diet. **Soluble fibre**  ( or fermentable fibre ) is found in : \*grains such as oats ,barley and rye; \*fruits like bananas and apples; \*beans and pulses ,like baked beans and chick peas; \*root vegetables like carrots and potatoes. \*Soluble fibre dissolves in water and helps to prevent constipation. **Insoluble fibre**  is found in: \*cereal foods like high fibre breakfast cereals; \*wholemeal bread and pasta as well as in brown rice and other whole grains; \*vegetables ,potatoes with skins ; \*nuts and seeds. Some types of fibre can be fermented by gut bacteria, producing substances which appear to be good for gut health. Producing “food” for gut bacteria can also help to increase the number of healthy bacteria in the gut. Consuming fibre-containing foods seems to be protective against colorectal cancer ; this may be because fibre helps waste products to move more quickly through the gut and also due to the fermentation of certain fibres by “friendly bacteria”. Soluble fibre can help reduce blood cholesterol ,so eating plenty of foods like oats, fruit ,root vegetables and pulses is a very good method of maintaining low cholesterol.

**How much fibre do we need ?** It is recommended that we should consume 30g.of fibre per day. On average ,we consume much less than this so that is why Government health agencies are constantly trying to get us to eat 5 A DAY ( or perhaps even more if we heed the very recent recommendations ) i.e. five portions of fruit and/or veg.per day .

Finally, a word about vegetarian eating, the benefits and the possible drawbacks. A meatless diet and one containing meat can be equally healthy. But let us remember that all diets have certain basic requirements: \*Sufficient carbohydrates to meet the calorie demands of exercise. \*An adequate intake of fat to give our bodies energy and to support cell growth. \*Adequate protein to supply nutritionally essential amino acids. \*Nitrogen to replenish body proteins. \*Various essential vitamins and minerals. A diet that uses no animal products lacks animal proteins, which normally supply large amounts of essential amino acids. Plant products can supply these amino acids but not by themselves. Ideally they should be used in various combinations to complement the profile of amino acids found in each food. It may also be difficult for vegetarians to consume the required number of calories – it is rather difficult to consume 3000+ calories per day if you’re only eating salads! Such an athlete would have to consume more cereals , bread, beans ,nuts and seeds.

And so to conclude , I’d simply like to repeat what was said at the start : eat a **balanced diet m**aintaining the correct proportions of carbohydrates ,fats and protein. And remember the Golden Mean ,so beloved by the ancient Greeks : Moderation in everything .

I wish to acknowledge the following sources for the information contained in this article : *The Olympic Book of Sports Medicine,*  edited by A.Dirix, H.G. Knuttgen and K.Tittel. *Lore of Running*  by Tim Noakes , MD. *Better training for Distance Runners*  by David E. Martin ,Ph.D and Peter N. Coe. *Advanced Marathoning* by Pete Pfitzinger and Scott Douglas. *Diet in Sport*  by Wilf Paish

*The next article will discuss what I call “ Complementary or supplementary forms of training” i.e.* plyometrics, weight training, sprint drills, box-jumps, etc. I call them “complementary” or *“supplementary” because , for the middle and long distance runner , they can never be a substitute* or replacement for actual running. As Steve Cram said a long time ago “ In order to be a great *runner, you need to do lots of running”. Or Frank Shorter ,on hearing that a certain great middle* *distance runner trained primarily on such a regime of plyos, drop jumps,drills ,etc., muttered “ You* *don’t run a 3:50 mile or a 2:10 marathon on good looks and a secret formula”. But, if you are a full-time runner and have the time and energy to incorporate them into your fitness regime , then they can have a very worthwhile place in your training programme and will* *complement, or supplement, your running programme. But I firmly believe that they can never be an* ***alternative*** *form of training for the distance runner.*