

Training factors affecting performance

[Business](#), [Management](#)



HSC Core 2: Factors Affecting Performance Chapter 5: How does training affect performance? Energy systems * alactacid system (ATP/PC) * lactic acid system * aerobic system Energy Systems The human body requires energy for its organs to function, internal processes to take place and to power muscular contractions for movement * Energy in the human body is stored in the chemical bonds that join atoms and is released when needed * The transformation of food, chemical energy, into energy that the muscles can use, mechanical energy, is the role of energy systems * Chemical energy is energy stored in bonds between atoms * Mechanical energy is motion or movement energy * Energy provided by food is measured in kilojoules (kJ) Adenosine triphosphate (ATP) is a high energy compound that stores and transfers energy to body cells * The ATP compound consists of a large molecule called adenosine and three smaller molecules called phosphate, each phosphate is held together by high energy bonds * When the last or terminal phosphate is detached, the energy stored in this bond becomes available and is transferred to the cells * Energy from ATP allows the fibres in muscles to contract, enabling movement * Once the phosphate molecule has detached it is referred to as Adenosine diphosphate * Resynthesis is the process of restoring ATP to its former state The three systems that make ATP available are: * The alactacid system (ATP/PC) * The lactic acid system (glycolytic system) * The aerobic system (oxygen system) * The alactacid and lactic acid systems are anaerobic pathways as they do not use oxygen for the resynthesis of ATP * The aerobic system uses oxygen for the resynthesis of ATP and is oxygen dependent * Although the energy systems are examined in isolation, they function together, the predominant energy

system is the one being most utilised at that point in time Alactacid system (ATP/PC) ATP supplies within the body are only large enough to enable one explosive muscular contraction and lasts 1-2 seconds * Further muscular contraction relies on creatine phosphate breaking down, which provides energy for the phosphate to combine with the adenosine diphosphate to once again form adenosine triphosphate * Creatine phosphate (CP) is an energy rich compound that serves as an alternative energy source for muscular contraction * CP supplies are exhausted in 10-12 seconds and takes only 2 minutes to be fully restored in the presence of oxygen * We have about 90 grams of ATP stored and about 120 grams of CP stored * There are no fatiguing by-products of this system, however heat is produced Lactic acid system Glycogen is the storage form of glucose and is used for fuel when blood glucose levels decline * Glycolysis is the process of using glycogen or glucose as fuel * Anaerobic glycolysis is a process where glucose is broken down in the absence of oxygen to produce energy * Lactic acid is produced because insufficient oxygen results in the partial breakdown of glucose, providing quick but limited ATP production, as well as the by-product lactic acid * As sufficient oxygen is not available during intense exercise, lactic acid levels rise and continue to rise as intensity increases * The fuel of the lactic acid system is carbohydrate in the form of glucose in the blood and stored glycogen * It is the dominant system used for intense activity performed between 30 seconds and 2/3 minutes * Excessively high levels of lactic acid prevent the muscle fibres from contracting and result in a rapid deterioration in performance * Lactate is processed in the mitochondria in the muscle cells, most is converted to carbon dioxide and water and some

is converted to fuel * The lactate threshold is the point at which lactic acid accumulates rapidly in the blood * Lactic acid diffuses from the muscle and into the bloodstream taking between 30 minutes and an hour * Metabolism is the sum of all chemical processes within cells that transform substances into energy * A mole is the gram-molecular weight of a substance

Aerobic system

- * Aerobic metabolism is the breakdown of fuel in the presence of oxygen to produce energy (ATP)
- * Glucose, fat and sometimes protein are used
- * As glycogen supplies are exhausted, fat becomes the dominant energy source
- * Fatigue occurs because fat requires more oxygen for metabolism than carbohydrate
- * It is the dominant energy system for exercise from about 2 minutes onwards
- * By products produced are carbon dioxide and water
- * To recover, it may take days to restore glycogen reserves depending on intensity and duration
- * E. g. triathlon, marathon, 1km swim, 10km run

Types of training and training methods

aerobic, e. g. continuous, fartlek, aerobic interval, circuit

anaerobic, e. g. anaerobic interval

flexibility, e. g. static, ballistic, PNF, dynamic

strength training, e. g. free/fixed weights, elastic, hydraulic

Types of training and training methods

The four types of training are:

- * Aerobic training
- * Anaerobic training
- * Flexibility training
- * Strength training

Aerobic training

Uses the aerobic system as the main source of energy supply

Training types include:

- * Continuous training
- * Fartlek training
- * Aerobic interval training
- * Circuit training

Continuous training:

- * Involves sustained effort for over 20 minutes e. g. jogging, cycling and aerobics
- * Heart rate must be within the target zone of 65%-85% max heart rate to enable physiological adaptations to take place
- * Long, slow distance training focuses on distance rather than speed

Fartlek training:

- * In

fartlek training, participants vary their speed and the terrain on which they are working, engaging both aerobic and anaerobic energy systems * Fartlek training is a combination of interval and continuous training because of its use of variations in speed and intensity * Intensity is varied through the use of bursts of speed, running up and down hills, group running with changing leadership and changing terrain types * Fartlek training is particularly beneficial for games players who are frequently changing intensity e. g. rugby, basketball and soccer

Aerobic interval training: Aerobic interval training involves alternating sessions of work and recovery * The short rest period does not allow enough time for full recovery and thus maintains stress on the aerobic system

Circuit training: * Circuit training requires participants to move from one 'station' to another, performing specified exercises at each until they complete the circuit * Can either work aerobic or anaerobic system depending on intensity and duration * Participants aim to complete the circuit in the shortest possible time

Anaerobic training * Anaerobic training uses high intensity work coupled with limited recovery to develop the anaerobic energy systems * Generally lasts less than 2 minutes and is of a high intensity * Develops greater tolerance for the lactic acid created

Short anaerobic training lasts less than 25 seconds and develops the ATP/PC system, medium anaerobic training lasts from 25 seconds to one minute and develops the lactic acid system and long anaerobic training lasts one to two minutes and develops lactic acid / aerobic systems

Anaerobic interval: * Is sprint training over short distances using maximal effort with rests

Flexibility training * Flexibility is the range through which joints and body parts are able to move * Flexibility is essential for

prevention of injury, muscular relaxation, decreasing soreness and tightness following exercise and increased range of movement, maximising performance * Flexibility is affected by factors such as age, sex, temperature, exercise frequency and specificity * The four common types of stretching are static, dynamic, ballistic and PNF Static stretching: During static stretching the muscle is slowly and smoothly stretched to a position of no discomfort which is held for about 30 seconds * Static stretching is safe and should be used extensively in the rehabilitation of injury and cool-down phase of training Ballistic stretching: * Ballistic stretching involves repeated movements such as swinging and bouncing to gain extra stretch * This form of stretching activates the stretch reflex which is an involuntary muscle contraction that prevents fibre damage if muscles are being lengthened beyond their normal range * Ballistic stretching should only be used by advanced athletes and even then should follow a thorough warm-up and another form of stretching due to the ability of the force and momentum of the movement to be potentially harmful Proprioceptive neuromuscular facilitation (PNF) stretching: PNF stretching involves lengthening a muscle against a resistance provided by a partner * It is aimed at stretching and strengthening the muscle in a safe environment, can be used as a warm up, cool down or in rehabilitation * The progressive cycle involves stretching the muscle group using a static stretch, isometrically contracting the muscle in the stretched position against the resistance of the partner for about 10 seconds, relaxing in the lengthened position for about 5 seconds, then repeating the static stretch and isometric contraction Dynamic stretching: * Dynamic stretching, commonly used in warm ups due to its attempt to

imitate the movements of the game, uses speed and momentum with movements experienced in a game to increase flexibility * Dynamic stretching is continuous but the end position is not held Strength training Strength training is a form of training where the muscular contraction is resisted by calculated loads, thereby building the strength of the muscle * Strength is the ability of a muscle or muscle group to exert force against a resistance * Muscle hypertrophy is a term that refers to muscle growth together with an increase in the size of muscle cells * Strength training programs can be used for building strength, developing power, developing muscular endurance, injury rehabilitation and general health benefits * There are many ways of creating resistance or an opposing force including free weights, weight machines, elastic bands and hydraulic resistance * Isotonic programs involves raising/lowering and pulling / pushing against a resistance to contract and lengthen muscle fibres * Isometric programs involve applying a resistance and using exercises in which the muscle length does not change * Repetitions are performed quickly to increase power and slowly to increase strength Free weights: Used to develop all muscles in a group at the same time * Use of barbells, dumbbells and hand weights * Most resistance is encountered when initiating the movement * Good technique is required to avoid injury * Include squat, bench press, bicep curl, calf raise, upright row and sit ups with weight Fixed / Weight machines: * Resistance is provided by stacked weights which can be adjusted by changing pin placements * Weight machines are particularly beneficial for isolating specific muscles for development e. g. pec machine * There is less chance of injury than free weights as tracks restrict the way each movement can be performed

Resistance bands (elastic): The bands are anchored by an immovable object or part of the body, and are stretched, creating a resistance * Most of the resistance is experienced at the end of the movement because this is where the elastic material is under the greatest tension * Is a cheap and portable form of resistance training Hydraulic resistance: * Resistance is felt through the entire movement and also with the corresponding movement to return it to its starting point * Greatest resistance is felt when performing movements at higher speeds Principles of training * progressive overload * specificity * reversibility * variety * training thresholds * warm up and cool down

Principles of training * Effective training requires the implementation of a number of important principles Progressive overload The overload principle implies that gains in fitness or adaptations occur only when the training load is greater than normal and is progressively increased as improvements in fitness occur * Training produces certain physiological changes that allow the body to work at a higher level of intensity * These adaptations will not take place if the load or resistance is either too small or too big * A resistance that is too high results in the onset of fatigue as well as possible injury and the discontinuation of the activity * Progressive overload in aerobic training results in increased cardiac output and increased oxygen uptake * The application of it to strength training will result in muscle hypertrophy which is directly related to an increase in strength * In endurance programs the load increases need to be small and the adaptations take place slowly * Fastest gains are made in flexibility, then in strength Specificity * The specificity principle states that the greatest gains are made when activity in the training program resembles the movements in the game or activity * This

principle is particularly important when considering the development of energy systems, muscle groups and components of fitness * Metabolic specificity refers to identifying the energy system or systems most appropriate to the activity and developing these systems through related training procedures Reversibility * The effects of training programs are reversible * This is referred to as the detraining effect Gains in aerobic fitness are gradually lost if training ceases, in strength programs losses are experienced quicker and even quicker in flexibility programs * If big gains have been made during training, greater losses will follow when training stops Variety * Repetition without variation can lead to boredom, injury and the overuse of individual muscles * General endurance, strength and power can be developed using a variety of techniques including swimming, plyometrics and resistance programs to supplement training * Plyometrics refers to a special range of exercises in which a muscle is lengthened using an eccentric contraction, followed by a rapid concentric contraction Training thresholds For improvement to occur we must work at a level of intensity that causes adaptations to take place * The magnitude of improvement is approximately proportional to the threshold level at which we work * The aerobic threshold refers to a level of exercise intensity that is sufficient to cause a training effect, is approximately 65 - 70% of MHR * The aerobic training zone is the level of intensity lying between the aerobic and anaerobic thresholds * The anaerobic threshold or lactate inflection point is characterised by lactic acid accumulation and fatigue * The principle can be applied to resistance training, with high reps being used to develop muscular endurance and high resistance and low reps being used to develop strength

Warm-up and cool-down * The warm up reduces the risk of injury, increases joint mobility and muscle length, increases body temperature, mentally prepares the athlete for training, stimulates the cardiorespiratory system * The warm up should last for a minimum of 10 minutes, lasting up to 40 minutes where explosive movements such as sprinting are required * The warm up should include general aerobic activity e. g. jogging, specific flexibility exercises, callisthenics which are repetitive movements performed on the spot such as push ups and star jumps and also skill rehearsal * The cool down minimises muscle stiffness and soreness, decrease body temperature slowly and disperses and metabolises lactic acid concentration * The cool down should include aerobic work of a decreasing intensity and stretching of muscle groups used

Physiological adaptations in response to training * resting heart rate * stroke volume and cardiac output * oxygen uptake and lung capacity * haemoglobin level * muscle hypertrophy * effect on fast/slow twitch muscle fibres

Physiological adaptations in response to training In response to training, the body makes adaptations or adjustments to the level of stress imposed on it * Although progressive improvements will be seen throughout a training program, it usually takes about 12 weeks to realise the entire benefits * Training will cause adaptations to a number of capacities, including resting heart rate, stroke volume and cardiac output, oxygen uptake and lung capacity, haemoglobin levels, muscle hypertrophy and fast and slow twitch muscle fibres

Resting heart rate * Is the number of heart beats per minute while the body is at rest * The average untrained male has a resting heart rate of 70 to 75 BPM * Training can lower this to 30 – 40 BPM * Training can reduce RHR by about one BPM each week for the

first few months of training * Low resting heart rates reflects larger cardiac hypertrophy which allows for a greater stroke volume Stroke volume * Stroke volume is the amount of blood ejected by the left ventricle of the heart during a contraction, measured in mL / beat * Stroke volume is notably higher at maximal exercise following an endurance training program * This occurs because training causes the left ventricle to fill more completely during the diastole phase than it does in an untrained heart * There is also more blood in circulation following training due to an increase in blood plasma volume, meaning that more blood is able to enter the ventricle * Blood volume can increase by half a litre after only 8 days of endurance training * The increased oxygen available to the working muscles results in improved performance Cardiac output * Cardiac Output (Q) is the volume of blood ejected by the heart per minute, determined by multiplying heart rate by stroke volume * Untrained individuals may have a Q of 15 – 20 litres per minute, whereas trained athletes Q can range from 20 – 40 litres per minute due to a large increase in stroke volume * Q is generally regarded as maximum output when given Oxygen uptake Oxygen uptake is the ability of the working muscles to use the oxygen being delivered * The most significant improvements in response to aerobic training are in oxygen uptake * As we begin to exercise the mitochondria in the cells use more oxygen in the provision of energy * Maximal oxygen uptake, or VO_2 max, is regarded as the best indicator of cardiorespiratory endurance because it indicates the maximal amount of oxygen that muscles can absorb and use at that level of work * A high VO_2 max indicates a superior oxygen delivery system * Measurements are expressed in millilitres of oxygen per kilogram of

bodyweight per minute (mL/kg/min) * Average VO₂ max levels are about 35 mL/kg/min and can be increased up to very high levels of even 80 or 90 mL/kg/min * A 15-20% increase in oxygen uptake is typical for the average inactive person who applies the FITT principle for a six-month period *

Increases in oxygen uptake and VO₂ max come from an increase in mitochondria numbers and their size as well as a possible increase due to increase in blood volume Lung capacity * Lung capacity is the amount of air that the lungs can hold * Total lung capacity is about 6000mL in males and slightly less in females * Lung capacity changes little with training, however it does cause some increase at maximal levels of exercise due to lower levels of residual volume Haemoglobin level Haemoglobin is the substance in blood that binds to oxygen and transports it around the body, it is contained in the red blood cells of the body * Each red blood cell contains about 250 million haemoglobin molecules * The average individual has about 14 grams of haemoglobin per 100 mL of blood * Most oxygen in the blood is transported by the haemoglobin in the red blood cells * They absorb oxygen at the lungs very quickly and carry this to the working muscles + organs *

Haemoglobin levels increase roughly 20% as a result of training predominantly due to an increase in blood volume as this increases oxygen-carrying capacity * Haemoglobin levels are also increased through altitude training as well as consuming a high iron diet Muscle hypertrophy Muscle hypertrophy is an increase in the size of a muscle or the cross-sectional area of the muscle as well as an increase in the size of muscle cells * Hypertrophy is induced by training programs that stimulate activity in muscle fibres causing them to grow * Without stimulation, muscle fibres can reduce in size,

known as muscular atrophy which is a wasting away or decrease in size *

The growth in the size of the muscle is a direct result from an increase in actin and myosin filament which produce muscle action, myofibrils which are the contractile elements of skeletal muscle and connective tissue which surrounds and supports the muscle * Muscle hypertrophy can occur in 4 – 6 weeks * Training cannot change the type of muscle fibre, only the cross sectional area * Hypertrophy is more easily achieved in males due to a higher concentration of testosterone

Effect on fast and slow twitch muscle fibres * The two types of muscle fibres are slow-twitch or type 1 muscle fibres (red fibres) which contract slowly and for long periods of time, and fast twitch or type 2 muscle fibres (white fibres) which reach peak tension quickly and are used for explosive movements * Most individuals have approximately even numbers of red and white fibres, while some individuals genetically have higher proportions of one type or the other * The bulk of the work is performed by muscles most suited to the specific type of activity *

Aerobic training causes hypertrophy of ST muscle fibres, an increase in the number of capillaries surrounding muscle fibres which improves gaseous exchange, increases number and size of mitochondria which produce ATP, increases Myoglobin content which transports oxygen from the cell membrane to the mitochondria and level of oxidative enzymes increases *

There are two types of fast twitch fibres, FTa which can use both aerobic and anaerobic metabolism and FTb which uses only anaerobic metabolism *

Training intensity can alter the relative proportions of subtypes in FT muscle fibres * Anaerobic training causes an increase in the efficiency and supply of ATP / PC, an increase in glycolytic enzymes, hypertrophy of FT muscle fibres

and an increase in lactic acid tolerance Chapter 6: Psychology and performance * Research continues to suggest that there is significant potential to improve performance through mental training Motivation* positive and negative * intrinsic and extrinsic Motivation Motivation is an internal state that activates, directs and sustains behaviour towards achieving a particular goal * Motivation is a force that can be manipulated to help an athlete achieve their full potential * Increasing the level of motivation in athletes can be achieved through recognising individual effort, supporting belief in one's ability, instilling a good work ethic and providing positive reinforcement and encouragement * The level of motivation we are able to achieve is affected by self-determination, parental pressure, response to support of others, money and the challenge Positive motivation * Positive motivation occurs when an individual's performance is driven by previous reinforcing behaviours * The athlete is conditioned to perform in expectation of the reward * Positive motivation relies on continual self-reinforcement and / or reinforcement by others such as a coach, family, friends or spectators * Positive motivation is more effective than negative motivation and also more sustainable Negative motivation * Negative motivation is characterised by an improvement in performance out of fear of the consequences of not performing to expectations * Negative motivation can cause a player to not take risks, be indecisive and lack creativity * While negative motivation can work on an irregular basis, in the long term it can destroy confidence, initiative and belief in oneself Intrinsic motivation Intrinsic motivation is a self-propelling force that encourages athletes to achieve because they have an interest in a task or activity and they enjoy

learning and performing the movements * Intrinsic motivation is the preferred type of motivation because personal reward and self-satisfaction are much stronger driving forces than anything imposed from outside * Results in a very high level of concentration where the individual is completely absorbed in the task Extrinsic motivation * Extrinsic or external motivation is motivation that comes from sources outside a person, such as a coach or parent * Extrinsic motivation focuses on the product or what can be gained * Is seen in forms such as praise, material rewards and financial remuneration * Intrinsic motivation is more sustainable Anxiety and arousal * trait and state anxiety * sources of stress * optimum arousal Anxiety and Arousal * Anxiety is predominantly a psychological process characterised by fear or apprehension in anticipation of confronting a situation perceived to be potentially threatening * Any sporting contest can give rise to anxiety Anxiety can also be entrenched in expectations, especially if one feels that they cannot be fulfilled * Arousal is a physiological process characterised by increased heart rate, tightness of muscles, increased blood supply and higher respiration rate Trait anxiety * Trait anxiety refers to a general level of stress that is characteristic of each individual * It varies according to how individuals have conditioned themselves to respond to and manage the stress State anxiety * State anxiety is characterised by a state of heightened emotions that develop in response to specific fear or danger * A certain level of anxiety might be considered beneficial in sports where aggression is a natural outlet e. g. rugby * However it can hinder performance in fine motor skilled sports e. g. archery Sources of stress * Stress is the non-specific response of the body to a demand placed on it * It can be felt by participants

in all sports * We feel stress building within us, produced by adrenaline which readies the body for action * Stress is characterised by increased blood supply, more oxygen to the lungs, increased glucose production, increased sweat production and tightened muscles * Factors that produce stress are called stressors and can develop from, in sporting situations, personal pressure, competition pressure and social pressure Optimum arousal Arousal is a physiological response and can be experienced prior to and during a performance * While anxiety is primarily a psychological state, arousal is essentially a physiological process * Arousal level can either facilitate or hinder the execution of specific skills * The individual performs a skill most successfully when the level of arousal is optimal for that particular task and that individual * Low arousal is optimal for tasks involving few muscle groups e. g. darts, as opposed to high arousal which is optimal for activities involving large body movements e. g. running Psychological strategies to enhance motivation and manage anxiety * concentration/attention skills (focusing) * mental rehearsal/visualisation/imagery * relaxation techniques * goal-setting

Psychological strategies to enhance motivation and manage anxiety * Uncontrolled anxiety can potentially have a negative impact on performance, but a complete lack of anxiety can undermine effort and achievement * Athletes are able to use strategies including concentration / attention skills, mental rehearsal / visualisation / imagery, relaxation techniques and goal-setting to ensure their mental and physical energy is channelled in the right direction Concentration / attention skills (focusing) * Concentration is the ability to link movement and awareness to the extent that the individual can

focus on doing, as opposed to thinking about doing * When an individual focuses on the task or activity, their thoughts relate to execution * Concentration can be improved through training that emphasises the process rather than the outcome * Through developing skills that block out distractions, using routines, avoiding negative thoughts and utilising self-talk an athlete is able to gain greater concentration Mental rehearsal / visualisation / imagery Mental rehearsal is the commonly used technique of picturing the performance or skill before executing it * It has been shown to enhance not only competition performance, but also the acquisition and building of motor skills * Mental rehearsal requires vivid, realistic pictures at performance speed in the mind and a sense of experiencing the movement * Mental rehearsal can improve performance as it focuses the mind on the correct execution of the skill, provides a clear idea of what has to be done and heightens concentration Relaxation techniques * Relaxation techniques are a series of techniques that seek to control the body's response to stress * Relaxation techniques may assist the athlete in control of arousal * Techniques commonly used by athletes include progressive muscular relaxation, mental relaxation, self-hypnosis, meditation and centred breathing Goal-setting Goals are targets that we direct our efforts towards and can relate to either performance or behaviour * They provide athletes with a reason to persevere with training over extended periods * The types of goals include short-term goals which can be achieved in a limited period of time, long-term goals which can be achieved only over a long period of time, behavioural goals which relate to improved behavioural expectations and performance goals which pertain to the athlete's desired level of success

Chapter 7: Nutrition, recovery strategies and performance

Nutritional considerations

- * pre-performance, including carbohydrate loading
- * during performance
- * post-performance

Nutritional considerations

Programs designed to improve performance must be supported by solid nutritional practices

- * The two most important nutritional considerations are the roles of carbohydrates and hydration
- * The type of food consumed prior to competition directly affects the quantity of energy available
- * Hydration involves supplying sufficient water to the body's cells
- * Fluid is important because it is the body's medium for cooling heated muscles and assists in temperature regulation by transporting heat to the outside of the body
- * A deficiency in fuel or fluid supply contributes to a substandard performance and can place the health of the athlete at risk

Pre-performance (carbohydrate loading)

- * Food consumed prior to activity is useful only if digested and its energy and nutrients are made available to where they are required in the body
- * Foods high in fat, protein and fibre such as meats require longer periods to digest
- * Athletes are advised to eat mostly complex carbs e. g. pasta, cereal, fruits and bread
- * Food ingested before a performance has the potential to cause discomfort
- * The appropriate quantity of food relates to the type of competition
- * A normal meal 3 - 4 hours before competition is usually appropriate, as the time period prior to competition becomes shorter, food intake should be in the form of snacks and liquid preparations
- * People competing in competition or events should drink adequate fluid in the preceding days, especially in the hours prior
- * Carbohydrate loading is a technique used to maximise the body's storage of glycogen in preparation for a high-intensity endurance activity of more than

90 minutes – can improve performance by about 2% - 3% and delay fatigue *

Muscle saturation of glycogen is best achieved through a balanced diet high in carbohydrates especially complex carbs and tapering of training for 2 to 4 days before competition *

About 6 – 8 cups of water is needed per day, which is about 1.5 – 2L of water, this amount is needed even before you take into account other factors such as heavy exercise, a dry or hot environment or being overweight. During performance Endurance events, particularly in hot and possibly humid conditions, can have a significant impact on the body's fuel and fluid supplies *

The need for carbohydrate and electrolyte replacement depends on a number of factors including intensity, duration, humidity, clothing type and individual sweat rates *

Electrolytes are salts and minerals, such as sodium, potassium, calcium and magnesium, that are important for many body functions such as chemical breakdown and nerve conduction, electrolytes are lost through perspiration during exercise *

It is suggested that 200 – 300 mL of fluid be taken in every 15-20 minutes during exercise *

It is especially important to be well hydrated when you are physically active as a loss of one or more per cent of your body weight due to sweating can lead to muscle cramps, dizziness and fatigue *

Hydration is essential for heat dispersion, temperature regulation, chemical reactions producing energy, waste disposal through sweating and to allow blood to flow to major organs which is essential in sports performance *

When you have lost an excessive amount of bodily fluid and are dehydrated you may experience thirst, discomfort, headaches, cramps, decreased blood pressure, dizziness, fainting, constipation and fatigue *

When you are dehydrated, your body still tries to maintain its cardiac output; the amount of blood that is

pumped around the body by the heart, by compensating for the loss of fluid by increasing the heart rate and constricting the blood vessels to try to maintain blood pressure and blood flow to organs * Dehydration is an excessive loss of water Post-performance A post-performance nutritional plan aims to return the body to its pre-event state as quickly as possible * Proactive recovery means that refuelling and rehydration begins immediately and continues for 8-12 hours following the performance * Depleted muscle and liver glycogen stores need to be replaced immediately through an intake of food and drink high in carbohydrates with a high glycaemic index * The glycaemic index is a ranking system for carbohydrates based on how they affect blood sugar level * Rehydration needs to take place to replace fluids and electrolytes lost during the event * Active rest is encouraged as it enhances the manufacture of red blood cells, new proteins and specific cellular components damaged by stress-related movements Supplementation * vitamins/minerals * protein * caffeine * creatine products Supplementation Dietary supplementation is found in many forms, including vitamins and minerals, protein, caffeine and creatine products * Supplements may be of little value if the diet is already well balanced in terms of nutritional requirements Vitamins * Vitamins are essential to maintaining bodily functions * Vitamins are required in only very small quantities in the body * A balanced diet is important because food is the main source of vitamins * The body is unable to manufacture vitamins * Vitamin supplementation should not be a response to a desire for improved performance, but rather arise out of special needs e. g. ill health * The intake of excessive quantities of vitamins A and D may contribute to muscle and

joint pain and headaches due to the body's ability to store them

Minerals

Minerals are essential for the body to function properly, but do not provide energy * They are found in the body and are necessary for it to function adequately * Iron and calcium are the two minerals that are most commonly deficient in athletes * Athletes should look to dietary sources rather than supplementation to gain adequate minerals

Protein

* Protein's primary importance to the body is its structural role in holding the cells together and in the growth, repair and maintenance of body tissue * High levels of protein are needed by strength athletes, endurance athletes in heavy training and adolescents undergoing a growth spurt * However changes in the dietary balance are the preferred method of supplementation

Caffeine

Caffeine does appear to improve cognitive processes, such as alertness * Caffeine does not appear to enhance performance in short-term high intensity activities such as sprinting * Diuretic properties of caffeine suggest that it should be avoided as it may contribute to dehydration * A diuretic is a drug that increases the amount of fluid (water and urine) passing from the body * The only evidence of caffeine enhancing performance is that it may assist specific metabolic processes, enhancing endurance performance * An ergogenic aid is a substance or practice that improves or is believed to improve physical performance

Creatine products

The body has two sources of creatine, production by body cells and food intake, particularly from meat * It is important in making energy available to sustain short duration explosive activity such as weight-lifting and sprinting * Creatine cannot be stored in the body * Muscle hypertrophy is more easily achieved when training is assisted by creatine supplementation, possibly related to the

increase in weight it causes * There is little, if any benefit of supplementation to enhancing performance

Recovery strategies * physiological strategies, e. g. cool down, hydration * neural strategies, e. g. hydrotherapy, massage * tissue damage strategies, e. g. cryotherapy * psychological strategies, e. g. relaxation

Recovery strategies aim to ensure that the athlete is able to resume normal training and competition within the time p of the training program * Active rest is still regarded as the most beneficial form of recovery * Rest allows both physiological and psychological revitalisation to take its course * During rest, muscles repair and rebuild while energy and fluid levels are restored to pre-event levels * Short-term recovery requires activities such as cool-down following training, together with low intensity exercise to promote soft tissue repair and disperse lactic acid * Recovery strategies can be categorised as physiological, neural, tissue damage or psychological

Physiological strategies (cool down, nutritional plan – hydration + fuel recovery) * Physiological strategies need to focus on the removal of metabolic by-products and a nutritional plan to replace lost fluids and energy-rich nutrients * An effective cool-down is the recommended manner for removal of metabolic by-products * The purpose of a cool-down following exercise is to gradually reduce heart rate and metabolism to the pre-exercise state while also assisting in the removal of waste products including lactic acid, which contributes to muscle stiffness and soreness * It is also designed to restore a number of other elevated body functions, such as ventilation rate, blood distribution and adrenaline levels back to normal * The cool-down should consist of 5-10 minutes of walking / jogging / slow swimming, with the aim of returning the body to pre-exercise temperature *

Static stretching is also important * Vigorous or sustained exercise that is not concluded with a cool-down may result in blood pooling, causing dizziness * A nutritional plan encompassing fluid recovery and fuel recovery is paramount * Drinking 600mL of water for every half kilogram of weight lost during exercise is recommended * During the first 30 minutes to two hours following exercise the muscles are most receptive to glycogen enrichment and this is the best time for fuel recovery * A high carbohydrate diet is recommended during exercise recovery Neural strategies (hydrotherapy, massage) * Neural strategies such as hydrotherapy and massage aim to relax muscles that have been fatigued or damaged as a result of high intensity exercise * Strenuous exercise impacts on the central nervous system and this may contribute to fatigue * Hydrotherapy involves the use of water to relax, soothe pain and assist metabolic recovery * Water provides support for movements, and eliminates jarring and straining movements that are associated with land drills * Typical hydrotherapy methods involve use of steam rooms, spas, underwater massage and heated swimming pools * Sports massage focuses on body and mental relaxation It is important as exercise induced tension can cause stress on joints, ligaments, tendons and muscles * Post-event massage claims to help relieve swelling, reduce muscle tension, assist in eliminating toxic by-products, promote flexibility and prepare the athlete for the next training session Tissue damage strategies (cryotherapy) * Cryotherapy involves the use of cooling to treat injury or quicken recovery from performances, particularly those that involve collisions and / or sustained intensity * Ice is the most used form of cryotherapy because of its ability to slow down the tissue inflammatory

process, preventing the build-up of waste Psychological strategies (relaxation) Use of psychological strategies represents an important phase in emotional and possibly spiritual recovery * Mind relaxing activities such as reading, listening to music, and watching movies or television are helpful and used by most athletes * The benefits of other more specialised psychological techniques such as progressive muscular relaxation, flotation, meditation, visualisation, centred breathing and positive self-talk are realised if practised frequently Chapter 8: Skill and performance * Skill is the ability to consistently perform movements with control and precision * The acquisition of skill is a gradual development process that requires that our cognitive (thinking) processes work with our physical abilities to learn how to perform movements that previously were unfamiliar to us * Acquisition is gaining possession of something Stages of skill acquisition * cognitive * associative * autonomous Stages of skill acquisition The stages of skill acquisition can be categorised into the cognitive or planning stage, the associative or practice stage and the autonomous or automatic stage Cognitive stage * Cognitive refers to mental processing of information, thinking and understanding * The fundamental requirement here is that the athlete gains an understanding of the task required * The learner may experience error, awkwardness and some disorientation * Positive learning should be reinforced and encouraged Associative stage * Associative means connecting or linking ideas * The associative stage is identified by a specific emphasis on practice * Errors still occur, but are smaller and less frequent than in the cognitive stage * A sense of fluency or smoothness develops as the learner's kinaesthesia improves Autonomous stage Autonomous means being in full control of actions so they

become automatic * Temporal patterning is developed, where their movement has a characteristic fluency as the sub-routines sequence and blend in aesthetically pleasing motions

Characteristics of the learner, e. g. personality, heredity, confidence, prior experience, ability

Characteristics of the learner * The speed with which learners are able to acquire certain motor skills depends on a number of factors, of which most are inherent features * Some characteristics of learners that affect the rate of learning are personality, heredity, confidence, prior experience and ability

Personality Personality refers to an individual's characteristic way of behaving * From a motor learning point of view, certain aspects of personality tend to be more favourable with certain learning environments * Attributes affecting learning include cooperativeness, willingness to listen, determination, enthusiasm, dedication, level of motivation, aggressiveness and willingness to take risks and learn * Traits are characteristics or observable features of a person

Heredity * Heredity refers to genetic characteristics inherited from our parents * Important hereditary characteristics are the relative percentage of fast-twitch to slow-twitch muscle fibres, somatotype, gender, height and conceptual ability * Somatotype is a person's body type or shape, with ectomorphic referring to linearity, mesomorphic referring to muscularity and endomorphic referring to roundness

Confidence * Self-confidence is a firm belief in one's own ability * Confidence develops from experiencing success in learning situations * Confidence leads to self-belief

Prior experience It is often easier to learn a new skill if similar movements have already been successfully acquired * Transfer of learning is an important reality in the acquisition of new skills * Lateral transfer is the transfer from one task to

another similar task e. g. forehand in ping pong and tennis * Vertical transfer is mastering a lower order task as a prerequisite for something much more difficult e. g. kicking using a kickboard and freestyle Ability * Ability is the ease with which an individual is able to perform a movement or routine * Ability incorporates a range of factors, such as sense acuity, perception, reaction time and intelligence * Acuity is sharpness The learning environment nature of the skill (open, closed, gross, fine, discrete, serial, continuous, self-paced, externally paced) * the performance elements (decision-making, strategic and tactical development) * practice method (massed, distributed, whole, part) * feedback (internal, external, concurrent, delayed, knowledge of results, knowledge of performance) The learning environment * The learning environment refers to everything outside the learner and embraces the skill itself, the situation in which it is practised, information from coaches and even the influence of surrounding weather conditions The nature of skill * Skills are commonly classified as open or closed, gross motor or fine motor, discrete, serial or continuous, and self-paced or externally paced Open and closed skills Open skills occur in an environment that is unpredictable and frequently changing * Closed skills occur in an environment that is stable and predictable * The closed environment is much more conducive to skill learning because the learner is not distracted by other factors * Skills can be placed along a continuum from closed to open Gross motor and fine motor skills * Gross motor skills require the use of large muscle groups for execution * Fine motor skills require the use of only small muscle groups to perform the movement Discrete, serial and continuous skills * Skills can be classified as discrete, serial or

continuous according to where they begin and end * Discrete skills have a distinct beginning and end that can be identified e. g. a forward role * Serial skills involve a sequence of smaller movements that are assembled to make a total skill e. g. a layup in basketball * Continuous skills have no distinct beginning or end e. g. swimming Self-paced and externally paced skills * Self-paced skills are movements for which the performer determines the timing and speed of execution e. g. bowling in cricket * Externally paced skills are movements for which an external source controls the timing e. g. batting in cricket Performance elements * The performance elements are decision making, strategic development and tactical development * The game-centred approach aims to focus on the whole game and all components Decision making Productive decision making is best achieved through observation, questioning, whole, part, whole approach, variation and creativity Strategic and tactic development * Strategic understanding refers to the way we play, where we should be at a particular time and what to do * Tactical awareness is about utilising ways of gaining an advantage over an opponent * Strategic and tactical development is built on the principles of technical efficiency, understanding and skilful execution Practice methods * The learning environment is further affected by the practice methods or training systems and routines designed to teach particular skills Massed and distributed practice Distributed practice (or spaced practice) involves a broken practice session, with the intervals of rest or alternative activities being longer than the practice intervals * Distributed practice works best when the performer lacks interest, the task is difficult, motivation is low or the task causes fatigue * Massed practice involves a continuous practice

session, with the rest intervals being shorter than the practice intervals *

Massed practice works best when performers are highly motivated and fresh

Whole and part practice * The whole practice method is applied when a skill is practised in its entirety * The part practice method is applied when a skill is broken into smaller components and each discrete sub-skill is practised separately * Whole-part-whole practice is a combination of both methods

Feedback Feedback is the information provided to the learner about the nature or result of their performance * The many types of feedback include internal, external, concurrent, delayed, knowledge of results and knowledge of performance Internal (or intrinsic) and external (or extrinsic) feedback *

Internal feedback occurs as a normal consequence of performing a skill and is received through the body's proprioceptive mechanisms or senses *

External feedback is all feedback other than that which occurs as a normal consequence of performing a skill * Augmented feedback, a type of external feedback, is supplementary information that is not given at the time that the skill is performed e. g. video analysis Concurrent (or continuous) and delayed feedback *

Concurrent feedback is received during the performance of a skill and it is relayed throughout the body by the proprioceptive mechanism *

Delayed feedback is received after the skill has been executed e. g. waiting for the result of a basketball shot Knowledge of results and knowledge of performance Knowledge of results is information about the outcome of a movement, it is always external and may come from a coach or judges for example * Knowledge of performance is information about the pattern of the movement during execution, it gives feedback on the quality of the execution of the skill Assessment of skill and performance * characteristics of

skilled performers, e. g. kinaesthetic sense, anticipation, consistency, technique * objective and subjective performance measures * validity and reliability of tests * personal versus prescribed judging criteria Assessment of skill and performance Characteristics of skilled performers * The movements of the skilled performer have certain observable qualities including kinaesthetic sense, anticipation, consistency and technique Kinaesthetic sense * Kinaesthesia (or kinaesthetic sense) refers to the system of sensitivity that exists in the muscles and their attachments Anticipation Skilled performers are better able to predict what may happen in specific situations Consistency * The skilled performer is able to perform the desired movement repeatedly Technique * Technique is a procedure or practical method applied to a particular task Objective and subjective performance methods * Measurement is the process of using numeric information to assess a particular physical ability * Subjective observation refers to a judgement of performance quality based on feelings, impressions or opinions rather than a measurement system * Objectivity is the extent to which a measure or test is independent of the observer Validity and reliability of tests Validity is the honesty of a test – that is, the degree to which it measures what it is supposed to measure * The validity of a test is enhanced by accuracy in prediction and ensuring test items contain the component being validated * Reliability refers to the degree of consistency of a test – that is, the ability of the test and tester to produce the same results on successive occasions Personal versus prescribed judging criteria * Criteria refer to the standards / qualities used for judging the value of a performance * Personal criteria are the preconceived ideas or expectations that an individual brings

to judge a performance * Prescribed criteria are established by a sports organisation or body and form the basis of assessment for competitions in that sport or activity * Appraisal is a judgement about the quality of something or somebody * The use of prescribed criteria seeks to absorb elements of subjectivity into a more objective framework