Exercise phsyiology notes

Exercise phsyiology notes STAGE 3 PHYSICAL EDUCATION Need To know — Exercise physiology 1. Environmental Conditions and Performance * Environmental Condition — HEAT 1. Methods of Heat Transfer Conduction - Heat exchanged by 2 objects in contact. Convection - Heat exchange by contact with a fluid that is flowing which will occur when heat is carried away from body by air or water currents. Accounts for 12% of heat loss. Radiation - Radiation occurs when heat is transferred from a warmer body to the cooler surroundings without physical contact. Evaporation - Is the cooling of the body as a result of the vaporisation of sweat. 2. Double Heat load — when does it occur and what impact does it have on the body / performance? A double heat load occurs when exercising in the heat. A high rate of sweating results in a significant loss of body fluid and consequently blood plasma volume. The reduced blood plasma volume inhibits the ability to continue to deliver blood to both the working muscles and the periphery for cooling via sweat evaporation. In addition, there is a decreased stroke volume, leading to an increased heart rate to compensate. With significantly reduced plasma volume, the body will priorities blood supply to the working muscles, rather than the periphery. This means less blood flow to the skin, limiting further cooling by evaporation and ultimately inhibiting continued performance. 3. Effect of heat on aerobic/anaerobic exercise. 1. At rest in the heat, Heart rate and stroke volume increase, to allow the body to send more blood to the skin, creating a cooling effect via evaporation. 2. At the commencement of exercise, heart rate and stroke volume continue to increase as the body must also send blood to the working muscles. 3. Whilst exercising, core body temperatures starts to increase which places extra strain on the body’s cooling mechanism - the hotter it is the more dependent the body becomes

on evaporation. 4. A hot ambient and core temperature creates a double-heat load. 5. Players should drink fluid to remain hydrated. 6. As exercise continues, players continue to drink, however fluid loss exceeds fluid intake (dehydration) resulting in dehydration occurring. 7. Dehydration results in a loss of plasma volume which affects the amount of blood which can be delivered around the body. 8. As blood volume drops, the body must try and maintain cardiac output to ensure enough blood is still sent to the working muscles and skin. 9. This leads to a reduced performance and an increase in core body temperature which may result in a headache, dizziness or nausea. Further sweat loss occurs leading to severe dehydration. 10. Further sweat loss occurs leading to severe dehydration. 11. With reduced cardiac output, the body must now make a critical decision, as to wether to send blood to the working muscles and vital organs? or to the skin for cooling? 12. The body chooses muscles and vital organs leading to reduced heat loss via evaporation. As a result core temperature rises placing the athlete at extreme risk of unconsciousness, coma, death if exercise continues. 4. Dehydration — signs / symptoms / dangers / prevention. Dehydration occurs when the amount of water leaving the body is greater than the amount being taken in. 5. Cardiac drift — when / why / impact on body / performance. * In an attempt to maintain cardiac output, Heart rate increases. * This increase in heart rate is relatively smaller than the decrease in Stroke volume, therefore cardiac output is reduced. * As a result, skin blood flow decreases and oxygen sent to working muscles is also reduced, placing extra strain on the body to maintain exercise levels. * A reduction in blood flow to the working muscles increase the production of lactic acid * A reduction in blood flow to the skin reduces the rate of sweating, inhibiting the body’s ability to

lose heat via evaporation. These changes lead to a rise in core temperature and negatively affect performance. 6. Heat exhaustion - signs / symptoms / dangers / preventing / impact on CV system. * Heat exhaustion is dehydration along with an ineffective circulatory system. Signs: * Decrease plasma volume * Decrease stroke volume * Decrease blood pressure * Increase heart rate Symptoms: * Dizziness * Headache * General fatigue * Nausea 7. Heat stroke — sings / symptoms / dangers / preventing / impact on CV system - Heat stroke is defined as severe dehydration. Signs: * Decrease plasma volume * Decrease stroke volume * Increase heart rate * Decrease cardiac output * Decrease blood flow to skin * Decrease sweating leading to dry skin. * Decrease heat loss by evaporation Symptoms: * Confusion * Coma * Brain damage * Death 8. Fluid Replacement — before / during / after. Hyper hydration Pre-Exercise: * 1L prior to exercise recommended * 300-400ml just prior on top of 600ml 3-4hrs before * Avoid drinks containing caffeine as they act as a diuretic and will cause you to go to the toilet thereby increasing fluid loss During Exercise: * Drink approx 200ml of water every 15 min during activity. * Don’t just drink when you are thirsty — you are usually dehydrated already at this point! * Avoid drinking just water as salt lost in sweat need to be replaced (sports drinks) Post Exercise: * Want to replenish back to pre exercise weight * For every 1L of sweat loss, consume 1. 5L as you will urinate some of this out * Consume slightly salty fluid to keep osmolality so you don’t urinate as much. 9. Methods to help core with exercising in the heat. 1. Drink Fluids before and during exercise - Hyper hydrate by consuming 300-400 ml just prior on top of 600ml 3-4 hours before. - Consume approximately 150-200 ml every 15 minutes during exercise. 2. Wear loose fitting, light coloured clothing to

permit free circulation of air between the skin and the environment, promoting convection and evaporation from the skin 3. Pre cool the core body temperature via a range of methods including: - Ice towels/Ice vests - Immersion in cool water - Drinking a slushie 4. Acclimatise 10. Benefits of Sports Drinks * Contains carbohydrates, sodium and potassium * Taste good * Provide athlete with rapid supply of energy (high GI) * Replace lost electrolytes (more effective in endurance events) 11. Hyponatremia * An abnormally low concentration of sodium in the blood * When a person is sweating profusely for an extended period of time, drinking too much water can cause problems because the body is losing salt and water in the sweat, but only the water is being replaced * Imbalance, or lack of salt can interfere with brain, heart and muscle function. 12. Acclimatisation — what is / how do you do / benefits of / adaptions. What is: * Heat acclimatisation is when heat tolerance is improved by repeated exposure to hot environments. How: * 5-10 days living and training in heat is recommended * The first sessions of heat acclimatisation should last for 15-20 minutes and be combined with light to moderate activity. * It should increase to 45-60 minutes daily for approx 8-9 days with an increase in exercise intensity and duration * Where: Athletes who are unable to use natural acclimatisation should use: * Climate chambers * Saunas * Sweat clothing * When: Should be completed 4-6 weeks prior to competition and then twice per week leading up to competition to maintain benefits. * Environmental Condition — HUMIDITY 1. Effect of humidity on heat loss / why? * Defined as the amount of water vapour that exists in the air. * Because our sweat evaporates more easily on a dry day, creating a better cooling effect. * Humidity places greater stress on the body as it limits the body’s ability to lose heat via evaporation making it more

difficult to exercise in the heat, placing the athlete at increased risk of overheating. * Environmental condition — COLD 1. Affect on Performance * Increase in submaximal VO2 at given exercise intensity. * For endurance exercise, shivering may lead to early glycogen depletion. * Fine motor skills deteriorate * Caused by reduced sensation in hands and feet due to vasoconstriction 2. Acclimatisation — what is / how you do / benefits of / adaptions. What is: * 7-10 days prior to competition * Allows chance for experimentation * Psychological adaption * Athletes train their body systems to generate more heat and better prevent heat loss. (No evidence to suggest physiological acclimatisation actually takes place — more of a psychological advantage) How you do: 1. Experiment with length of warm up 2. Experiment with layered clothing 3. Psychological acclimatisation 4. Ensure adequate fluid replacement as water loss will be increased via the need to humidify dry, cold air before it enters the lungs. Adaptions: 1. Peripheral Vasoconstriction - Involves the redirection of blood flow, away from the skins surface and towards the body’s core, to help minimise heat transfer from the blood to the cold. 2. Shivering - Involuntary muscular contractions designed to help increase heat production. 3. Piloerection - When the hairs on the body stand on end and trap a warm layer of air close to the skin to help keep the skin surface warm. 3. Hypothermia — signs / symptoms / do’s / dont’s Symptoms: * Feeling cold * Shivering * Loss of concentration * Confusion * Lethargy * Facial skin turns grey or blue * Loss of coordination Do’s/Dont’s: * Environmental Condition — ALTITUDE 1. How does altitude affect performance / Pressure gradient. * At high altitude, air has a reduced barometric pressure, causing a reduction in the pressure of oxygen entering the lungs — this causes less oxygen to enter the lungs, inhibiting

performance. * At altitude, there is a reduction in the pressure of O2 entering the lungs. This reduces the pressure difference with the result being less O2 diffusing from the alveoli into the blood. * A reduced pressure difference at altitude causes less O2 to be transported to the tissues, reducing exercise performance. Pressure Gradient: * Gas exchange takes place due to a pressure difference called a pressure gradient. The alveoli is high in O2 and therefore is high in pressure. The blood is low in O2 and therefore low in pressure. This pressure differential causes O2 to move from the lungs into the blood. 2. Chronic and Acute adaptions CHRONIC 1. Increase Haematocrit: Caused by an increase level of EPO which is secreted by the kidney to act on red bone marrow to increase red blood cell production — occurs within 2-3 hours of arriving at altitude. 2. Increase Mitochondria: Powerhouse of the cell and the site for ATP production. Increases the rate of ATP production. 3. Increase aerobic enzymes: Increases the rate at which ATP is produced. 4. Increase Capillaries: Allows for greater surface area for diffusion of O2 at the site of the muscle and the lungs. 5. increase Myoglobin: Responsible for transporting O2 molecules to the mitochondria therefore improving the rate of ATP production. 6. Increase 2, 3 DPG: Lasts 2-4 weeks after leaving altitude. Assists with the unloading of O2 at the muscle tissue and reduces affinity of haemoglobin for O2 which improves ability of cell to grab hold of O2 and therefore taking it in better. ACUTE: 1. Increase pulmonary Ventilation: Because the “ absolute" amount of O2 available in the air is reduced, the body will hyperventilate in an attempt to increase amount of O2 getting into the lungs. 2. Increase Heart Rate and Cardiac Output: Because the “ absolute" amount of O2 available in the air is reduced, the body will increase heart rate in an attempt to increase the amount of O2 getting into

the working muscles. 3. Decrease Plasma Volume to increase concentration of haemoglobin in the blood 3. Acclimatisation — what is / how do you do / benefits of / adaptions Method 1: Live High Train High * Usually require going to a mountain 2000 — 3000m above sea level to live and train for a periods of 3-4 weeks. * Acute mountain sickness often occurs as body comes to terms with hypoxic stress placed on the body. * As a result athletes required to stay longer, sometimes placing logistical and financial strain on the athletes. * As a result, reduced benefits in performance due to reduced training intensity over a prolongs period of time — DETRAINING. * Best suited to preparing teams to compete at altitude, not to compete at sea level. Method 2: Live High Train Low: * This involves daily intermittent exposure to artificial altitude environments whilst maintaining normal training intensities. * Hypoxic apartments, altitude houses and tents are used where the pressure of O2 in the air is manipulated to simulate conditions at altitude. * These artificial chambers allow athletes to sleep in altitude induced environments whilst still training under normal conditions at sea level. * This method is seen to be more beneficial as it allow players to maintain their training intensity whilst still getting the added benefit of altitude exposure. * Live at altitude for 3-4 weeks to gain chronic adaptions. * Go to altitude camps twice per year for 3-4 weeks per camp. Training intensity is comprised due to conditions and detraining can occur. * Return to sea level and increase training intensity to benefit from the chronic adaptions gained during the camp. Method 3 Live Low Train High: * Intermittent exposure to artificial hypoxic environment. * Athletes live at sea level but train in hyperbaric chambers or altitude tents to simulate a hypoxic environment. * No evidence suggests that this method is effective in gaining the chronic

adaptions achieved by using the “ Live high train low" method. 2. Nutrition in Sport 1. The role of a Balanced Diet * A balanced diet contains a healthy amount of macronutrients — proteins, CHO and fats as well as essential minerals, vitamins and water. * By consuming these nutrients, it ensures the body: * Meets the energy demands * Allows tissue growth and repair * Provides energy for metabolic function 2. Role of Carbohydrates, fats, Proteins as Fuel sources. Functions of Protein: (10-15%) / HT (15%) * Growth of muscle tissue * Repair of muscle tissue * Production of red blood cells * Contributes to ATP production when carbohydrates and fat stores are depleted. * For athletes in heavy training a protein intake between 1. 5-2. 0 g/kg of body mass on a daily basis is sufficient and won’t require a supplement. Role of fats: (25-30%) / HT (15%) * Fats (stored as triglycerides in muscle cells and broken down into Free Fatty Acids) are the major energy source during rest (60%) and light to moderate exercise with little input during intense exercise. Role Carbohydrates: (55-60%) / HT (15%) * To supply energy to the muscles during rest, low to moderate intensity exercise and high intensity exercise. major fuel source during aerobic activities. * The carbohydrate molecule has an energy yield of 17kj per gram. 3. Order of use — explain fuelling of energy systems. * At low intensity exercise, for an untrained athlete, energy will be supplied by 60% carbs and 40% fats. * At low intensity exercise for a trained athlete, energy will be supplies by 30% carbs and 70% fats. * At higher intensity exercise, for an untrained athlete, energy will be supplied by 80% carbs and 20% fats. * At higher intensity exercise, for a trained athlete, energy will be supplied by 50% carbs and 50% fats. 4. Glycogen sparing — what is it / how do you do it / benefits of glycogen sparing. * The ability of an athlete to spare glycogen supplies by

using an alternative fuel source during physical activity. This can be achieve via the following methods; 1. Training Effect * Through an aerobic training programme, athletes are better able to break down fats for given intensity, sparing glycogen for later in the event. 2. Caffeine consumption * By consuming caffeine before the event, it better enables the athlete to break down fats at the start of the event, sparing glycogen for later in the event. 3. Pre-event meal * By consuming low GI meals 1-4 hours prior to the event, it increases blood glucose levels allowing for glycogen sparing for later in the event. 5. High GI Vs. Low GI — when should they be consumed and why. High GI: * Break down quickly during digestion — therefore have immediate effect on increasing blood sugar levels. * Best consumed during and immediately after the event. * Rapid absorption and release of energy into blood stream provides opportunity to top up glycogen stores, helping with glycogen sparing. * Immediately after exercise muscles are most responsive to topping up fuel supplies, therefore high GI foods best served here. Low GI: * Break down slowly during digestion — releasing glycogen gradually into the blood stream. * Best consumed as part of the ore-event meal and after the event to replenish supplies. * Slower release of glucose into the bloodstream helps keep blood glucose levels topped up prior to the race. * Assists with repletion of muscle and liver glycogen stores in the 24 hours post exercise. 6. Pre event meal - goals / when consumed / Glycemic index / examples of suitable food. * Consumed 1-4 hours prior to competition * Consume low GI foods for slow release of glucose into the bloodstream. * The body tends to use the foods most recently digested as energy source — this assists with glycogen sparing. * Consume approx 600-1000ml fluid 4 hours prior to event to assist with hydration 7. During event meal - goals / when consumed /

Glycemic index / examples of suitable food. * Consume 30-60g of high GI carbohydrates per hour, or 1g/kg of body mass every hour. For example sports bars and jelly beans. * Consume approx 150200ml fluid every 15 minutes to prevent dehydration. * Sports drinks with 5-8% carbohydrate concentration are consumed to spare glycogen stores for later in exercise and also prevent dehydration. 8. Recovery meals - goals / when consumed / Glycemic index / examples of suitable food. * Takes at least 24 hours for glycogen replenishment after heavy endurance work * 1g/kg of body mass of high GI carbohydrate within 30 minutes of event. * Consume at least 7-10g/kg body mass of carbohydrate over the next 24 hours. * Consume fluid which equates to 1. 5 x weight loss 9. Rehydration * Consume 1. 5 x weight loss in fluids. 3. Nutritional Supplements — Illegal ergogenic aids 1. Anabolic Steroids How used / administered / loading protocol: * Increase the performer’s size and strength through the facilitation of muscle development and the improved rate of tissue repair. Performance Enhancement: * Increases levels of strength and power as athletes are able to train harder and more frequently. Side effects: * Decrease testicular volume * Acne * Liver damage * Aggression * Hypertension * Infertility * Heart disease Likely Users: * Body builders 2. Human growth Hormone How used / administered / loading protocol: * Body builders and other strength and power athletes take HGH because they believe it will increase muscle mass, strength and burn fat. * Athletes believe it has similar effects as anabolic steroids but is much harder to detect. Performance Enhancement: * Increases levels of strength and power as athletes are able to train harder and more frequently. Side effects: * Acromegaly — Medical condition that involves the overgrowth of the facial bone and connective tissue, causing a protruding jaw and eyebrow

bones. Your hands and feet become abnormally large and your internal organs begin to grow. * Enlargement of the heart * Hypoglycaemia * Swelling of the brain Likely Users: * Body builders * Wrestlers 3. Diuretics How used / administered / loading protocol: * Increases volume of urine secreted and is used by performers trying to make weight. * May also be used as a masking agent by diluting the concentration of illegal substances in urine. Performance Enhancement: * Allows athletes to lose large amounts of weights in a shot period of time and the restore the weight by drinking fluids. Side effects: * Weakness or dizziness * Muscle cramps * Diarrhoea * Joint pain Likely Users: * Boxers 4. Beta Blockers How used / administered / loading protocol: * Taken prior to an event to bring about benefits in sports where the body needs to be still and calm. Performance Enhancement: * Reduce heart rate, muscle tremors and pre-competition tension, benefiting athletes participating in target sports as this allows them to release/fire the projectile between heart beats. Side effects: * Drowsiness or fatigue * Hypotension * Shortness of breath or trouble breathing * Weakness or dizziness Likely Users: * Archer * Golfer 5. Stimulants How used / administered / loading protocol: * Taken before an event to improve awareness and aggression. Performance Enhancement: * Increases awareness, aggression and masks fatigue, improving performance. Side effects: * Anxiety * Restlessness * Insomnia * Dependence * Ineffective heart regulation and dehydration. Likely Users: * AFL player * Soccer player * 6. Narcotic Analgesics How used / administered / loading protocol: * Mask pain and allow the performer to continue to perform despite the injury which increases the chance of the injury getting worse. * Some are illegal and athletes can be caught out taking simple medications which may contain

banned substances. Performance Enhancement: * Masks pain and allows an injured athlete to continue to perform and train even when they are injured. Side effects: * Dependence * Drowsiness or light headiness * False sense of well-being Likely Users: * AFL player * Soccer player * Cricketer 7. Blood Doping How used / administered / loading protocol: * Remove approximately 1L of blood from an athlete in the lead up to a major tournament. * The blood is then separated into plasma and red blood cells with the plasma reinfused back into the athlete’s body and the red blood cells frozen for storage. * Over the following weeks, the body naturally restores the removed red blood cells through the secretion of EPO. * Just prior to competition, the frozen red blood cells are added to the body through transfusion . Performance Enhancement: * Increases the number of red blood cells in the body and therefore oxygen carrying capacity of the blood improving VO2 MAX by 20-25%. Side effects: * Transfer of blood born diseases * Blood clots * Stroke and heart failure especially when dehydrated. Likely Users: * Tour De France rider. 8. EPO How used / administered / loading protocol: * Hormone that is naturally found in the body. Performance Enhancement: * Injecting the hormone increases the rate of manufacture of red blood cells which increases the oxygen carrying capacity in the blood stream, improving VO2 Max. Side effects: * Blood clots * Stroke * Heart failure Likely Users: * Tour De France rider. 4. Nutritional Supplements — legal ergogenic aids: 1. High GI Carbohydrate Powders * Highly concentrated carbohydrate powders are used to assist an athlete in the process of carbohydrate loading or for refuelling the body’s energy systems following exercise. * Easy to consume large amounts as they do not leave the athlete feeling full from fibre consumption. * For example; Polyjoule and Polycose. 2. Carbohydrate

loading * Is a nutritional intervention aimed at delaying the depletion of glycogen stores. It occurs when the athlete increases the amount of carbohydrate consumed prior to competition with the aim being to store extra glycogen in the liver and muscles. There are 2 methods: 3 day method: * Consume approximately 7-8 g/kg of body mass of carbohydrates for the 3 days leading up to competition * Players can still exercise but they must significantly taper the amount of exercise completed leading up to competition 1 day method: * Consume approximately 8-10g/kg of body mass of carbohydrates on the day before the event. * Tapering or reducing of training load is required in order to spare muscle glycogen stores Advantages: * Carbohydrate loading avoids the depletion of glycogen stored by increasing muscle and liver glycogen stores. * By sparing glycogen, it allows aerobic athletes to maintain a higher intensity for a longer period of time. Disadvantages: * Binding of H20 and carbohydrate molecules increases water absorption, causing an increase in weight. Polycose, Polyjoule: * 94 — 95% concentration * Excellent for carbohydrate loading * Too concentrated to consume during exercise Lucozade: * Not as high but still very effective for carbohydrate loading and too concentrated to consume during exercise. Likely Users: * Marathon runner * Tour De France riders * Triathletes 3. Creatine * Creatine is a naturally occurring compound located in the skeletal muscle . * It’s obtained via the consumption of the following food sources: meat, poultry and fish. * Athletes will often increase their intake via the consumption of supplements. Rapid Loading protocol: * 4-20g/ day for a total of 5 days * May increase muscle Creatine by up to 25%. Slow loading protocol: * 2-8g / day for a total of 10 days Advantages: * Can increase Creatine stores in the muscle by up to 25% * Improves ATP and phosphate

creatine resynthesis in recovery — this improves the athletes ability to produce repeated efforts leading to increased training benefits. * Increase in phosphate creatine stores in muscle means the ATP/PC system can work for longer before anaerobic glycolysis takes over as the dominant energy system. This delays the onset of muscle inhibiting hydrogen ions. * Creatine allows power athletes to increase training volume and decrease recovery time. Disadvantages: * Some athletes report feelings of cramping and gastrointestinal pain. * May reduce the body’s own ability to make creatine, leading to dependence. * Increases the storage of water in the muscle — associated with rapid weight gain. Likely Users: * Sprinters * Baseballers * Throwing events (Eg. Javelin) 4. Fluids/ Sports Drinks * Sports drinks are flavoured drinks that rapidly deliver fuel and fluids when digested * They contain 6-8% carbohydrate concentration and are designed to be consumed during and after performance. * They are not effective in carbohydrate loading as they don’t contain sufficient amounts of carbohydrates. Performance Enhancement/ Advantages: * Taste good so you are more likely to want to drink them * Work to hydrate you and give your body an immediate source of energy as they are High GI. * The added salt (Sodium) provides more rapid absorption of fluid and retention of fluid. Likely Users: * Cricket players * Hockey players * AFL players 5. Glycerol * A 3 carbon molecule naturally occurring in the body Performance Enhancement: * When ingested, it is absorbed and increases the concentration of the fluid in the blood and tissues. * This means fluid consumed with the glycerol is not excreted until the extra glycerol consumed (supplement) is removed by the kidneys or broken down by the body. * Allows body to retain extra fluid temporarily — known as water loading. * It is most effective in moderate to

high intensity exercise in the heat where fluid intake can’t match fluid loss during exercise. * Also effective in rehydrating quickly following ‘ making the weight’ activities. (Eg, Boxing) Side Effects: * Headaches and gastrointestinal problems * Weight gain due to water loading. 6. Caffeine * For maximum benefits, 3-6mg/kg of body mass is to be consumed approximately 60 minutes prior to competition. * This equates to 210-420mg for a 70kg athlete Performance Enhancement: * Acts as a analgesic reducing the perception of effort and therefore increasing the time to exhaustion in short distance events. * Stimulates the CNS, increasing alertness, reaction times, and arousal levels. * Thought to also create a glycogen sparing effect through the oxidation of free fatty acids. * Through the mobilisation of fat as a fuel source during moderate to high intensity exercise, the athlete spares glycogen supplies improving performance in long distance events. Side Effects: * Potent diuretic — This may cause an unnecessary loss of fluid pre exercise, having a negative effect on the athletes ability to regulate temperature, particularly during hot conditions. * Irritability — muscle twitching * Insomnia — Withdrawal effects * Headaches — excessive intake may lead to over arousal Likely Users: * 800 m runner * AFL player * Badminton player. 7. Bicarbonates * Bicarbonate buffers against the build up of H+ ions and lactate which have a fatiguing effect when working anaerobically. * Consumed as a powder added to liquid. * Take approx 300mg/kg body mass 60-90 minutes prior to exercise. Advantages: * Bicarbonates increase resting pH levels * During high intensity exercise, a decrease in pH levels affects performance through impaired muscular contractions. * The consumption pre exercise delays the build up of H+ ions, inhibiting the effects of acidosis during intense activity. Disadvantages: *

Diarrhoea * Gastro-intestinal cramping * Vomiting * Muscle spasms * Irritability Likely Users: * 400 m sprinter * Sprint cyclist * 2km rower 8. Protein Advantages: * Growth of muscle tissue * Repair of muscle tissue * production of red blood cells, hormones and antibodies * Contributes to ATP production when carbohydrates and fat stores are depleted Disadvantages: * Increases risk of osteoporosis * Increased risk of colon cancers * Impairs kidney function 9. Vitamin/ mineral supplements * If daily fruit and vegetable intake is good then these are probably not necessary. * However, if you want to make sure your vitamin/mineral levels are adequate use a Multi- vitamin/ mineral supplement. * Supplements don’t make up for a poor diet. 10. Sports bars and gels Sports bars: * Low in fat whilst providing source of protein and carbohydrate. * Useful fuel source during and after exercise — should be consumed with fluids to be most effective. * Not as effective for pre loading as it doesn’t contain enough carbohydrates. Gels: * Concentrated form of carbohydrate (60-70%) found in an easy to consume sachet or tube. * Most effective for endurance athletes (last longer the 90 mins) during and post exercise. * Should always be consumed with fluid. * Advantage of being easily carried by an athlete. 11. Liquid meal supplements * Low-fat powder or liquid mixed with water or milk. * Contains approximately 50-70% carbohydrate concentration, 15-20% Protein and low to moderate levels of fat. * Used as a meal replacement, liquid pre game meal, carbohydrate supplement (training/loading) Advantages: * Excellent as a pre-game meal * High carbohydrate, low fat, some vitamins and minerals * Very easy to consume — taste good and easily absorbed by the body * Good post activity snack to assist with refuelling glycogen and protein stores. 12. Iron * Iron deficiency in the blood may lead to anaemia. * As a result, the oxygen

carrying capacity of an athlete is reduced affecting aerobic performance. * This affects mainly females, adolescents or athletes undergoing heat or altitude acclimatisation. Symptoms: * Fatigue * Lifeless * Susceptible to infection Sources of Iron: * Meat, Cereals and vegetables * Iron supplements. * Recommended athletes not meeting guidelines via balanced diet should consume supplements for a period of 2-3 months or until the deficiency is rectified. 5. Training Programs 1. Periodisation Define: * Periodisation is the planning well in advance of training variable to achieve optimal performance at the most crucial times. What: * Involves varying the volume and intensity of training . Why: * Help to avoid staleness, overtraining and burnout * Promote higher levels of enthusiasm in the player group * Ensure proper application of the principal of progressive overload in the physical conditioning of players. * Plans for recovery periods How: * Make an annual training program which takes into account preparation, competition, evaluation and transition phases. Monitoring: * This is used to monitor fatigue and recovery leading up to competition to prevent overtraining. 2. Tapering Define: * Involves DECREASING the VOLUME of training whilst MAINTAINING or INCREASING INTENSITY an athlete does to allow the body time to recover from the stresses placed on them during training. What: * Physically — The taper period should be for long enough to allow repair to tissue damaged during training and the re-fuelling of energy stores. * Mentally — The aim of taper is to help the athlete reach their ideal performance state. * Long Taper = Strength, Power * Short Taper = Endurance Why: * To make sure an athlete is physically and mentally fresh leading into competition and to reduce the chance of over training. How: * Reduce training volume and maintain or increase training intensity to a level

greater than, or equal to competition activity. * Increase the use of recovery techniques between sessions to improve quality of recovery. * Monitoring diet to ensure athlete has adequate glycogen stores. * Individualise the program to ensure athletes needs are met Monitoring: * The purpose of a taper is to monitor fatigue, diet and training load to prevent injury and overtraining prior to competition. 3. Peaking Define: * Is the term used to describe a temporary training state which allows the athlete to perform at their optimal level. Characteristics: Physiological: * Injury free * Improved rate of recovery * Optimal cardiovascular, muscular and energy systems * Responds automatically to demands Psychological: * Increased self confidence * Ignores irrelevant cues * Mentally relaxed whilst still alert Tactical and Technical: * Ideal technical efficiency * Tactically prepared How: * Before an event, athletes can refer back to their journals to see what factors may have contributed to their IPS and try and replicate these factors leading into contest. * A performer may see a particular trend developing which helps them get into their IPS and can try replicate that for each performance. * Getting into the IPS is easier to do when the task requires performance to be at an optimum level to achieve a challenging but attainable goal. Monitoring: * The performer should consider emotional (arousal), mental and physical characteristics of their ideal performance and record them. 4. Recovery Define: * A return to a normal state of health, mind or strength. What: Physically — It is required to overcome the fatigue caused by physical activity, to repair body tissue. Physiologically — It is needed to allow the athlete to enter the next contest or activity in an optimal mental state. How: Nutritional recovery: Where the body’s energy stores are refuelled by consuming high carbohydrate foods and isotonic drinks. protein

is also consumed to promote muscle tissue repair. Physical recovery: Aimed at regenerating the physiologically capacities of the athlete. This includes: * Hydrotherapy * Sport massage * Stretching * Hyperbaric oxygen therapy * Rest Psychological recovery: Aimed at returning the athlete to an optimal mental state. Starts immediately after the game with a debriefing which provides all players a chance to express their thoughts and feelings about the just completed performance. Physical recovery strategies: 1. Cool Down * Helps reduce muscle soreness and aid recovery 2. Replenishment of Glycogen Stores * Dependent on duration and intensity of exercise performed * Aim is to maximise replenishment in first 1-2 hours following exercise with 1-2g/kg body mass when muscles are most responsive to storing glycogen. 3. Replenishment of Fluids and Electrolytes - Consume approx 1. 5l fluid for every 1kg body mass lost 4. Rest - Sleep routines very important — try and wake up at the same time each day, lie down only when you are sleepy. 5. Hydrotherapy * Includes movement in water or alternative use of hot/cold or ice baths. * Non weight bearing activities effective in removal waste products. 6. Massage * Aids recovery physically and physiologically. * Should occur 1-2 hours after training or competition * Helps relax the muscles and helps clear away lactic acid by increasing blood flow — should not be used on soft tissue injuries for first 72 hours. 7. Hyperbaric Oxygen Therapy * Used to treat soft tissue injuries and promote recovery * Athletes breathe in pure oxygen to increase oxygen concentration in the blood. * Results in more oxygen been delivered to fatigues muscles and a mare rapid recovery process. 8. Recovery Clothing * Use of compression clothing with brands such as skins help reduce fatigue, minimise soreness and improve recovery. Monitoring: * Coaches need to monitor how effective

the recovery programs is to ensure that the athletes are at their best possible physical, mental and emotional state for each performance. The most common methods include: Training logs: Are used to monitor what is done at training. * How hard the found the training session * The distance covered * The volume and intensity Lab testings: * Self monitoring of heart rate and blood pressure * Blood tests to determine Red blood cell and haemoglobin level. Questionnaires: Are used to determine how the athlete rate their moods, energy level, motivation to train, feelings about their team mates. Questionnaires which can be used include: * Profile of Mood States (PQMS) * Total Quality Recovery (TQR) * Recovery Stress Questionnaire for Athletes (RESTQ) Observation: An acute coach can gather plenty of information about the athletes simply by observing their current behaviour and comparing it to their behaviour when they are at their peal. This includes: * Mental approach — Is the athlete motivated/ enthusiastic as normal?/Are there unusual lapses in concentration? * Performance Levels — Is the player under performing?/ Are times up and speed down? * Body Language — Does the player have positive body language?/ How does it compare to normal? * Communication — Regular conversation with the players keeps the coach informed on how of players are feeling and how they are coping. 5. Overtraining Define: * Overtraining occurs when an athlete has been repeatedly stressed by training to the point where the rest periods between sessions are no longer adequate for recovery to occur. As a result, training no longer leads to performance improvement. What: * Overtraining frequently occurs in athletes who are training for competition or a specific event and train beyond the body’s ability to recover in the time available. It is an imbalance between work and rest. * Overtraining is

common in young sportsmen / sportswomen who are training with several teams at once. eg, school, club, district, state. Effect on Performance: Optimal training load = Peak performance Optimal training load = Peak performance PERFORMANCE PERFORMANCE Under training- Player not achieving optimal performance Under training- Player not achieving optimal performance Overtraining — Performance deteriorates Overtraining — Performance deteriorates TRAINING VOLUME PSYCHOLOGICAL | PHYSIOLOGICAL | BEHAVIOURAL | Decrease self esteem | General soreness | Decreased effort | Easily annoyed and moody | Weight loss | Performance drops | Depression | Increase in viral illness | Gives up | Loss of interest in the sport | Increased injuries | Lacks normal co-ordination | Insomnia | Increased resting heart rate | | Concentration drops | Loss of appetite | | Causes of Overtraining: * Workload too high * Lack of variety in training sessions leading to staleness * Insufficient recovery from injury * Too many competitions requiring repeated maximal efforts * Incorrect application of progressive overload principle * Insufficient recovery methods, or lack of, leading to imbalance between rest, training and competition. Preventing Overtraining: * Have a well planned training programme which incorporates regular rest. * Look for variations in the player’s behaviour, moods and performance. * Administer psychological tests such as the Profile of Moods States * Educate players and coaches of signs and symptoms of overtraining. * Individualise training programs. * Have variety in the training sessions. Cross training achieves this. * Train at different venues * Keep well hydrated * Reduce training load (volume/intensity) and, if need be, stop training if the athlete shows signs and symptoms of overtraining. Physical | Physiological | Nutritional | Monitoring Recovery | - Hydrotherapy- Sport Massage-

Stretching- Hyperbaric oxygen therapy- Rest/Active recovery | - Meditation- Autogenic training- Progressive muscle relaxation- Imagery- Breathing- Flotation- Music | - High carbohydrate diet- Protein- Fluid | - Training logs- Observation- Lab Testing- Questionnaires | * Ensure a balanced diet including high carbohydrate intake to maintain energy stores. * Macro cycles, mesocycles, micro cycles — what are they? How do they interrelate? Macro cycles: Large blocks of training within each phase. Mesocycles: Medium blocks of training within a macro cycle. Micro cycles: Smaller blocks of training (week, day, session) Interrelation: * The phases of the annual training program (preparation, evaluation, transition) are broken down into macro cycles. Mesocycles are smaller blocks of time that together form a macro cycle. Mesocycles are between 4-12 weeks long. A micro cycle is a smaller unit of time normally between 3-10 days long. Several micro cycles for a mesocycles. The Annual Training Program: Phases of the Annual Training Plan: PHASE/MACRO CYCLE OF TRAINING | TRAINING PRINCIPALS & METHODS | PREPARATION PHASE | - Usually lasts 6-12 weeksGeneral:- Training designed to improve aerobic base.- High volume training with low levels of intensity.- Continuous, interval & fartlek training- Flexibility training- Fitness testing used to gather baseline data and comparison to other players, teams, previous seasons etc. Specific:- Emphasis towards practising game specific skills and strategies.- May need to be personalised depending on players needs- During this times we see a reduced training volume with increased intensity- High intensity interval training- Weight training- Plyometrics training (up to 2x per week)- Agility training | COMPETITION PHASE | - Focus at training moves to match specific intensities, durations & tactics.- Principle specifically crucial- Fitness is maintained — dependent on

individual situations (injury and illness position, number games played)- Recovery sessions are critical, particularly after games when players are often sore.- Constant peaking & tapering are critical in allowing players sufficient recovery during the season.- This forms what's known as a " training wave" and is of particular significance where fixtures are played weekly. | EVALUATION PHASE | - Involves the analysis of the strengths and weaknesses of the programme, to determine what worked and what didn't. - Questionnaires, checklists and quantitative data can be used to gather information.- Coaches need to determine whether the physical and mental skills introduced, practised and used during the annual programme were beneficial to the performer. | TRANSITION PHASE | - Training volume and intensity significantly reduced to allow for full physical and psychological recovery.- Older players in particular find this time crucial in allowing the body to recover.- Some level of aerobic fitness should be maintained to avoid detraining through involvement n enjoyable activities using different muscle groups.- Surfing- Different sports- Monitor nutrition to ensure a return to active participation close to playing weight.- Opportunity for corrective surgery and rehabilitation- Specialised programs to correct structural or skill deficiencies. | 2. The training wave — draw, explain key features. 3. How do you prepare for finals / major competitions. * Just prior to finals, players need to be at peak physiological and psychological levels of fitness * As a result teams will often increase their volume of approximately 1 month before the finals and then undertake a taper to ensure optimal energy stores and physical and mental freshness. * An increase in training volume means an increase in recovery techniques is required to ensure athletes avoid injury and can maintain workload. 4. Training Programs and player maintenance *

Important to understand the body cannot continuously be overloaded — it needs time to recover and it is usually during the competition phase of the season that the maintenance phase takes place. * During pre-season, the body is constantly overloaded in an attempt to: * Develop an aerobic base * Increase strength * Increase speed/agility * Increase power * During the season, it is important athletes maintain these fitness levels whilst increasing recovery to ensure they are physically fresh for games. Tis is achieved by: * Reducing volume and increasing or maintaining intensity of training. 5. Training Programs and Injured athletes/ injury management. * For injured athletes, modifications to the training program must be made to ensure the athlete prevents any further injury from occurring. * It is also critical the athlete minimises the amount of detraining that occurs during the injury phase. * Cross — training is an extremely effective means of resting injured body parts whilst still maintaining some level of physical activity and cardiovascular fitness. * Alternatively, athletes may participate in specialist activities that allow injured body parts to rest whilst still maintaining fitness in non-injured areas. Prevention of injuries in children: 1. Correct warm up and cool down 2. Understand and modify the rules * Teach rules of the sport to help prevent injury to self and others * Decrease size playing field * Use smaller and softer equipment * Rule changes * Reduce playing time * Increase use of protective equipment. 3. Physical conditioning 4. Thermoregulation 5. Even competition 6. Correct technique TOTAPS: * Talk * Observe * Touch * Passive movement * Skills test TOTAPS: * Talk * Observe * Touch * Passive movement * Skills test STOP: * Stop * Talk * Observe * Prevent further injury STOP: * Stop * Talk * Observe * Prevent further injury Injury Management: DR ABC: * Danger * Response * Airway * Breathing *

Compressions Rehabilitation: * Range of motion — Improve ROM 80-90% of pre injury pain free ROM has returned. * Endurance — 2nd phase of recovery to improve endurance using little or no weight. * Strength — increase weight or resistance so only sets of 10-12 reps can be completed before fatigue. * Skill — Re-educate muscles to perform specific movements for their specific sport. Rehabilitation: * Range of motion — Improve ROM 80-90% of pre injury pain free ROM has returned. * Endurance — 2nd phase of recovery to improve endurance using little or no weight. * Strength — increase weight or resistance so only sets of 10-12 reps can be completed before fatigue. * Skill — Re-educate muscles to perform specific movements for their specific sport. Soft Tissue Injuries: * Heat * Alcohol * Running * Massage Soft Tissue Injuries: * Heat * Alcohol * Running * Massage RICER: * Rest * Ice * Compression * Elevate * Referral 6. Training Programs and specific energy system requirements. * The specific energy system requirements of any training session will be dependent upon the type of activity being conducted. * An understanding of the components of fitness for a given sport helps coaches develop training programs to meet the demands of the sport. * An analysis of a game of soccer would demonstrate the need for speed, agility and aerobic endurance. * An analysis of a sprinter would demonstrate a need for speed and power. * Consequently, training sessions would be tailored towards developing these physical attributes and the energy systems which fuel them. * By specifically developing the energy systems which fuel the components of fitness for a given sport, athletes are better able to improve performance. This concept relates to the training principle of SPECIFICITY.