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| ***Illegal Performance Enhancing Substances*** | | | | |
| *Substance / Practice* | *Examples* | *Perceived benefits* | *Side effects* | *Other Info* |
| Anabolic Agents | * Anabolic Steroids | * Attempt to maximise the anabolic properties (protein building) * Used to increase muscle bulk , power and strength * Increases protein synthesis – blocking the hormones that cause the breaking down of muscle tissue following very intensive exercise * Reduces recovery time * Can train at higher intensities | * Enhanced aggressive behaviour * Dependence * Depression * Hypertension * Cancer * Sudden death * Testicular atrophy * Male breast enlargement * Alopecia * Female breast atrophy * Facial Hair * Increased masculinity | * Common in sports requiring strength * Related to the structure and function of testosterone |
| Peptides | * Human Growth Hormone (HGH) * Corticosteroids * Insulin-like Growth Factors (IGF’s) | * Increase muscle and bone development * Induce a state of euphoria * Anti-inflammatory preparation * Used to normalise testosterone levels in testing * Naturally occurring hormone that stimulates protein synthesis * It is the hormone through which the growth hormone exerts most of its growth promoting effects * Used to increase muscle bulk * Reduces muscle cell breakdown * Reduce body fat | * Thickening of the blood * Blood clots * Increased risk of heart attack and stroke * Dehydration * Thickened skin * Hypoglycaemia (low blood sugar levels) * Swelling of the brain * Enlargement of the heart * Diabetic coma | * Used in sports requiring strength and power |
| Erythropoietin (EPO) |  | * Increase number of red blood cells, oxygen carrying capacity and VO2 max * Increases endurance | * Thickening of the blood * Heart attacks, stroke * Dehydration | * Administered by a series of injections over a period of time * It is a naturally occurring hormone in the body and is therefore difficult to determine |
| Beta-2 agonists | * Salbutamol | * Improves uptake of oxygen * Improved endurance performance * Widens the airways allowing a larger uptake of oxygen * Can increase muscle mass when injected * Reduce body fat percentage * Promote faster recovery | * Tremors * Tachycardia (high resting heart rate) * Palpitations (racing heart) * Headaches * Nausea * Sweating * Muscle cramps * Twitching * Restlessness * Dizziness * Sleep disturbances | * Commonly inhaled to treat asthma * Can have anabolic effects if taken into the blood stream |
| Beta-Blockers | * Acebutolol * Atenolo | * Slows heart beat * Controls blood pressure * Reduce pre competition tension * Stops hands from shaking * Not useful in vigorous sports | * Hypotension (low blood pressure) * Cardiac failure * Asthma * Tiredness * Decreased performance capacity in endurance events | * Used in sports that require relaxation; shooting, archery * Reduces the heart rate to permit shots or arrows to be fired between heartbeats |
| Hormone antagonists and modulators | * Anti-oestrogenic substances | * Act to decrease the amount of oestrogen in the body or block oestrogen receptors * Used in conjunction with anabolic steroids to increase testosterone levels * Can counteract the undesirable side effects associated with anabolic steroid use | * Hot flushes * Gastrointestinal disorders (constipation, Irritable bowel syndrome) * Fluid retention * Venous thrombosis (blood clots) | * Can be used for the hormone treatment of breast cancers |
| Diuretics and other masking agents | * Diuretics * Plasma Expanders | * Help eliminate fluid from the body to assist in masking weight * Presence of other drugs are masked by diluting their concentration in urine samples * Plasma Expanders are used to mask the use of EPO | * Dehydration * Cramps * Muscle strains * Irregular heartbeat * Kidney and heart failure * Headaches | * Commonly used to treat patients with kidney and liver diseases |
| Stimulants | * Amphetamines * Cocaine * Ephedrine | * Used to brighten the mood and arousal * Eliminate or decrease feelings of fatigue * CNS is directly acted on to speed up parts of the brain and body * Increased alertness * Increased aggression * Increased competitiveness | * Increase blood pressure * Increase body temperature * Create insomnia * Irregular heartbeat * More severe – heart attack or stroke | * Long term use can result in tolerance to the drug so a larger amount is taken |
| Narcotics | * Heroin * Morphine * Methadone * Codeine | * Enable athletes to continue competing while injured * Reduced pain from injury | * Impaired judgement, co-ordination and balance * Run the risk of further more serious injuries * High risk of dependence * Respiratory depression or failure * Lethargy |  |
| Glucocorticosteroids | * Powerful anti-inflammatory agents | * Used to treat chronic inflammatory conditions; arthritis, asthma, inflamed joints * Illegal because they lessen pain and reduce the sensation of tiredness | * Fluid retention * Mood alteration * Hyperglycaemia (high blood sugar) * Osteoporosis * Softening of connective tissue * Weakening of muscles, bones and ligaments |  |
| ***Illegal Performance Enhancing Practices*** | | | | |
| Enhancement of oxygen transfer | * Blood Doping | * Increase in red blood cell count is achieved by transfusing the athlete’s own blood or from another donor of the same blood type * Blood is removed and the red blood cells are harvested, stored and later reinfused * Boosts oxygen carrying capacity of blood * Enhances delivery of oxygen * Improves VO2 max * Improves endurance capacity | * Risk of transfusing blood borne viruses; hep B AIDS * Blood clots * Increased viscosity of blood * Increased risk of heart attack and stroke * Dehydration | * Oxygen is delivered to the muscles by being diffused into plasma (3%) or combined with haemoglobin (97%) |
| Genetic manipulation (gene doping) | * DNA * Transfer of cells or genetic agents * Agents that alter gene expression | * The non-therapeutic use of cells, genes, genetic elements or modification of gene expression, having the capacity to enhance athletic performance * Improve suitability for certain sports and events * Improve training, recovery and actual performances | * Still in the experimental phase, therefore the side effects are unknown | * Research is still being conducted and is extremely expensive * Hypothetically, genes linked to EPO could be manipulated to improve endurance performance |
| Chemical and physical manipulation | * Tampering; catheterisation or substitute or alter urine samples to avoid detection * Intravenous infusions | * Alters samples so that performance enhancement is not detected * Can provide quick hydration | * IV infusion – infection, fluid overload, electrolyte imbalance |  |
| ***Legal Performance Enhancing Practices*** | | | | |
| High Altitude Training | * In excess of about 2000m above sea level, the amount of oxygen available to the body is significantly less * It is difficult to maintain training for adequate amounts of time as the body is in serious oxygen deficit | * When our brain senses that we are not receiving normal levels of oxygen, it produces greater number of RBC. * Increases the ability to transport oxygen to the working muscles * Acute responses to training at altitude; increased breathing rate and HR * Most significant benefits;   + Increased RBC volume   + Increased haemoglobin volume   + Increased blood viscosity (low resistance to blood flow)   + Increased capillarisation | * Acute responses to training at altitude; decreased blood flow to the brain, headaches, nausea, sleeplessness and decreased VO2max | * It can take an athlete up to 3 weeks to acclimatise to the new environmental conditions |
| Hypoxic Tents | * To overcome the cost and inconvenience of living at altitudes sports scientists have developed the hypoxic tent that stimulates living at altitude | * Sleeping in an altitude simulated environment allows the body to achieve some adaptations, while permitting the athlete to train at an oxygen rich environment - this is hoped to combat the decrease in VO2 max |  |  |
| Intermittent hypoxic training | * Wearing a hypoxic mask intermittently during training | * Increases the ability to use oxygen * Increases the efficiency to breath in, transport and utilise oxygen * The heart and lungs increase their work rate and size * Oxygen absorption increases * Dilation of capillaries increases, enabling RBC to get into the capillaries and allowing greater volumes of blood and oxygen to be transported * Levels of EPO, RBC, haemoglobin and myoglobin all increase * Production and release of HGH increases |  |  |

Legal Performance enhancing practices also include;

* CHO loading
* Creatine Supplementation
* Fluid Replacement
* Caffeine Ingestion
* Protein Supplementation

All previously covered in Chapter 12.