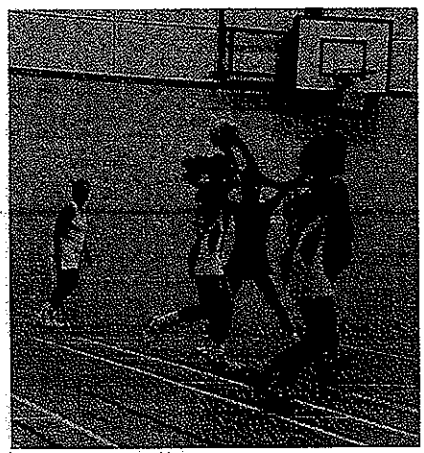
Suzy Russell

A PHYSIOLOGICAL DEVELOPMENT PLAN TO ENHANCE MY ACCELERATION & POWER IN NETBALL



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Introduction:

My name is Suzy Russell and I am undertaking an 8 week development plan in order to improve my performance in netball by enhancing my acceleration and power. I began playing netball at the age of 7 and my love for the sport grew immensely when my family relocated to Australia for a period of four years when I was nine. I am currently playing U19 south regional netball, for Trinity. I captained my school 1st VII last year and will again this year. I also represent the senior Trinity team at times, playing in poly-league games and tournaments. Last year I was involved in the England development pathway and hope to become involved again in the near future.

My near future aim in netball is to play in the National Talent League level however my knee injuries may greatly restrict my ability to do so. My speed / acceleration are what I believe to be a weakness in my game, and therefore are components that I need to improve in order to reach the next level. Over the course of the past 18 months I have become more aware of the need for me to improve my acceleration and power in order to keep up with the ever quickening pace, intensity and physicality of modern netball. I believe this could significantly improve my performance and allow me to reach my goal of playing netball at the next level.

My main positions are; WD, C and GD. However for school I often play many different positions. At the highest level of netball I play, I am primarily as a mid-court player, acceleration and power are important components of my game, they can improve my ability to outpace or move from an opponent to get free and make an interception.

I plan to improve my acceleration and power through the use of; SAQ (speed, agility, quickness), weights and sprint/interval training, over a period of 8 weeks.

In order to see my improvement and check whether my development plan is improving my acceleration and power and at what rate I will need to test; before I complete the programme, at a mid-point during the programme and at the end of the programme.

In order to improve there are numerous factors will which need to be controlled, changed and monitored in order to ensure I get the most out of my programme and develop and improve as much as possible during the 8 week period. These factors include; warming up, cooling down and recovery, diet and fuelling, the principles of training, periodisation and protocols of training and testing.

My Physique:

Weight: Beginning of programme – 65.8k

Height: 1.75m

Body fat %: Beginning of Programme – 17%

Knee injury and physiotherapy:

I am currently seeing a physio for injury of my knees, i complete additional exercises in order to ensure my core strength is as strong and my ligaments, tendons and muscles are all loose enough to not cause severe pain and place excess pressure on my joints. There is currently no specific diagnosis

of my knee problems, 'jumpers knee', patella tendonitis and anterior tibial knee pain have all be explored and I am still under ongoing physio treatment in hope to resolve and reduce the impact of the problem. This restricts my ability to complete some ranges of movement and specific movements aggravate the pain, therefore throughout my programme I need to be especially aware of this and avoid any exercises which particularly stress my knees and cause increased pain.

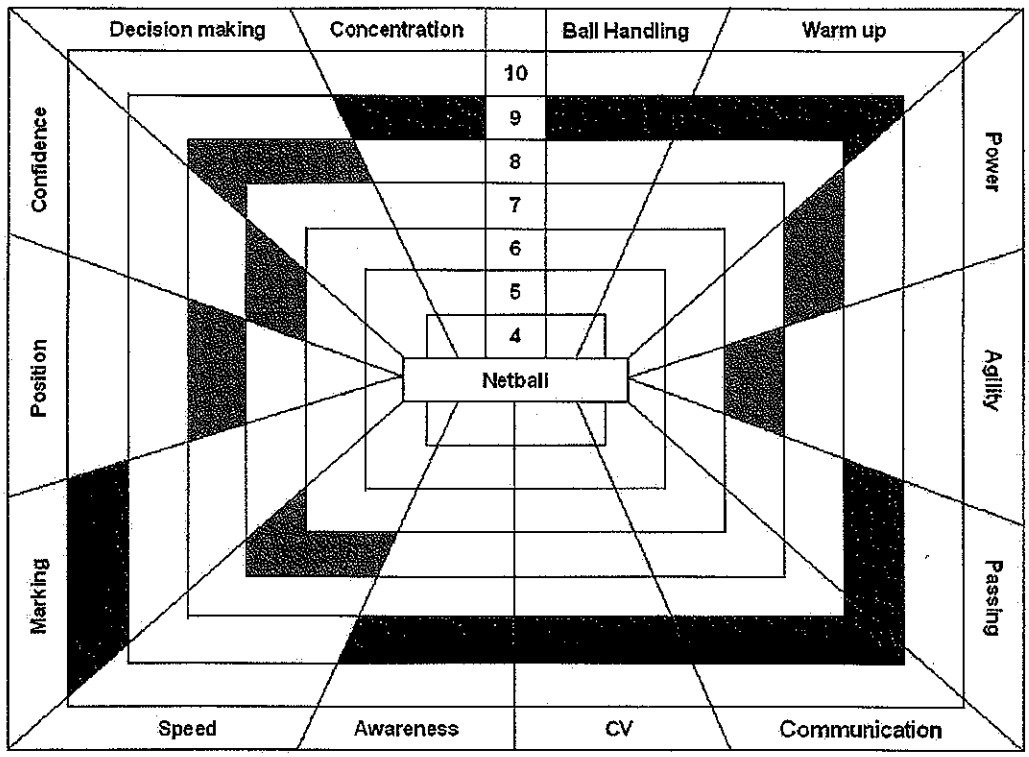
Physical activity readiness questionnaire:

In order to complete my development plan I needed to complete a Physical Activity Readiness Questionnaire (PARQ) to ensure it was safe for me to train and was not going to negatively affect my health. Below is my completed PARQ:

1. **Has your doctor ever said that you have a heart condition and that you should only do physical activity recommended by a doctor?** – No
2. **Do you feel pain in your chest when you take part in physical activity?** –No
3. **In the past month have you had chest pain when not taking part in physical activity?** – No
4. **Do you ever lose your balance because of dizziness or ever lose consciousness?** – No
5. **Do you have a bone or joint problem that could be worsened or adversely affected by a change in your current physical activity?** – My knee pain tends to be aggravated and made worse by large amounts of exercise
6. **Is your doctor currently prescribing drugs for blood pressure or a heart condition?** – No
7. **Do you know of any other reason why you should not take part in physical activity?** – No

Strengths and weaknesses:

In order to decide upon what I wanted to complete my development plan on I assessed my strengths and weaknesses. Below is a performance profiling chart which visually outlines some aspects of my game as strengths and weaknesses.



This shows that physiologically I am strongest in the areas of cardiovascular fitness, concentration ball handling, ability to warm up, passing, communication, awareness and marking are all strengths of my game. I have outline power, agility, speed, positioning, confidence and decision making as weaknesses and as a result decided to improve my power and acceleration in order to eliminate this as a weakness and hopefully turn these aspects into a strength of my game.

Technically, tactically and psychologically there are areas which I believe I could improve on, such as confidence and decision making, however throughout my development plan I am to improve a physiological aspect of my game, hence my decision to improve power and acceleration.

Definition of related components of Fitness:

Acceleration: the rate of change of velocity. It is a vector quantity possessing both magnitude and direction. (Acceleration = change of velocity / time)

Power: The ability to exert maximum muscular contraction instantly in explosive bursts of movements (strength x speed)

Reaction Time: The time taken from the presentation of the stimulus to the execution of the necessary subsequent action

Although there are many technical aspects of my game which need to be continuously improved in order to ensure my game is up to a high standard, I feel that acceleration and power are the components which is limiting my chances of reaching the next level and therefore I have chosen to improve it with this development plan.

Methods of Training:

In order to improve my acceleration and power I am going to use a combination of SAQ, weights and interval/speed training. All of these training methods should work cohesively to improve the aspect of my game which I believe to be the weakest.

Speed, Agility Quickness: is a method that is patented by SAQ International and the method is used in many countries including the United Kingdom, United States of America and Australia. The method concentrates on the neuromuscular system and developing and honing the neurological firing patterns, connecting the brain and the muscles to allow the body to work more efficiently. The aim of the training is to improve the neuromuscular system and therefore allow the initial movement to be more automatic and efficient, leading to more explosive and precise actions. The use of horizontal ladders and concept of 'quick feet' encourages the brain to send more frequent messages to the muscles. Explosive training and resisted and assisted running aim to improve power and explosive muscle contraction.

Speed training: involves attempting to improve the rate at which muscles fibres contract once they are stimulated. The neuromuscular system also aims to improve the firing patterns of fast-twitch muscle fibres, Improvement in neuromuscular transmission will result in faster recruitment of contracting fibres. Placing extra stress on muscle fibres through speed and acceleration training will encourage the use of more fibres and therefore the use of speed training will help to improve my acceleration, speed and power. Assisted speed training and resisted speed training can also improve stride frequency and speed / stride length.

Interval training: consists of the idea of periods of work interrupted by periods of rest. A work/rest ratio is created depending upon the intensity of work in the work period. During the work phase I must work to near my maximum capacity to benefit from the training and give myself enough time to recover fully in the rest period, allowing me then to work again at a very high intensity.

Weight / Resistance Training: is a predominately anaerobic, it can improve many aspects including power and therefore as a result acceleration and power. Free and fixed weights can allow me to target different muscle groups. It is important to find the correct balance in order to benefit my speed and acceleration, the intensity and duration and therefore important. I will gain dynamic strength and increase my power and as a consequence increase by ability to accelerate.

Anaerobic Training: My training will stress the ATP-phosphocreatine (PC) system (the alactic energy system) and the Lactic Acid system, both of which are anaerobic. Therefore my training programme should improve my anaerobic threshold and therefore be able to work for longer anaerobically. Anaerobic training will bring result in the following adaptations:

- My body's ability to convert lactic acid into pyruvic acid will be increased by enabling my body to build up greater quantities of the enzymes used in the process
- Improve my ability to utilise lactic acid
- Increase my ability to buffer lactic acid and therefore convert, transport and break down lactic acid
- Increase my ability to tolerate high levels of lactic acid

The adaptations of my body to anaerobic training will also include:

- Increased thickness of my ventricular myocardium
- Increased strength of ventricular contraction
- Decreased end systolic volume
- Increased stroke volume
- Myofibrillar hypertrophy
- Increased muscle mass

All of the adaptations that my three types of anaerobic training will bring about will benefit my ability to accelerate and my power and as a consequence improve my performance as a player. In games it will provide me with the ability to beat opponents and play to a better standard. The improvements should also allow me to train harder and faster and therefore concentrate on technical aspects of my game, e.g. passing, whilst completing drills to a higher intensity.

Principles of training:

The principles of training include; Specificity, Progression, Overload, Reversibility / Regression, Tedium, Threshold, Variance, Frequency, Intensity, Time and Type. I need to apply them to my development plan in order for it to be successful and improve me performance long term.

Specificity:

This revolves around the idea that the training needs to specific to the aspects you aim to improve and the exercises are specifically tailored to suit the individual and what they aim to achieve. SAQ training, Speed training and weight / resistance training all to be successful are required to be very specific, with the reps, sets, distances and weights being important. The programme also needs to be specific to the athlete, their other commitments and needs to be successful.

Progression:

This involves the idea of increasing the intensity or timing of training to improve, as the body reacts to and adapts to training the loads will need to be increased to ensure there is continuous improvement and a plateau is reached where the training becomes a norm and is not placing any additional stress on the body, and therefore the body does not adapt. I need to increase the intensity of my SAQ and sprint/interval training; which I will do by increasing the number of reps or sets or decreasing the recovery time in between. My weight/resistant training will be progressed by increasing the weights and the number of sets and reps.

Overload:

This principle fits in and works with the idea of progression, and adding increased stress to the body in order to encourage adaptations to occur. Overloading the body and placing more stress on it encourages the body to respond and adapt quicker. However, during my development programme I need to take into account the other training sessions and matches I am doing at the time, e.g. for club and school. If I overload my body to a too greater extent and my recovery periods are not great enough, I will begin to no longer have positive adaptations and my performance may even decrease as a result, resulting in negative effects on the results of my development play.

Regression / Reversibility:

If I cannot train for a certain reason, e.g. I am impacted by an injury, then the principle of reversibility will occur. Approximately a 1:3 week ratio is applied, for every one week that an athlete didn't train for; it takes a period of three weeks to return to the original state of fitness that the athlete was in before they stopped training. This is therefore something important to consider when undertaking my development plan.

Threshold:

Gauging the correct training threshold is vital in order for my development plan to be successful. I need to work at the correct intensity and time in order to improve. In sprint / interval training I need to ensure the distances, sets, reps and rest intervals correct. With regards to SAQ training the number of sets, and timing of rest intervals will be important as for the training to benefit the exercise must be completed with the correct technique, or it is not work completing the exercises.

Weight / Resistance training threshold refers to the weight of the resistance, it should be approximately 80-85% of my one rep max.

Tedium:

A large problem associated with training it tedium, the idea of repetitive training becoming boring and the athlete undertaking the programme no longer being motivated. To successfully complete my programme I need to be motivated and avoid tedium; completing some sessions at the same time others who are working towards the same objective of improving their speed / acceleration and listening to music may both help me to avoid tedium and keep me motivated when training.

Variance:

In order to avoid tedium I also need to apply the principle of variance to my development plan. This involves varying my programme to ensure it is not repetitive, I am including three types of training in my programme and therefore this should help to avoid tedium.

Frequency:

This is how often I complete my training, the occurrence of training I aim to complete 4 sessions per week. The frequency of training is important as recovery periods in between training are determined by this. The frequency of training will be influenced by the intensity and the duration of the training completed.

Intensity:

The intensity of each session will be determined by the distances covered, number or sets, reps, rest periods and weights of resistance.

Type:

This refers to the form of training which I will undertake, types of training I will use in my development plan are; weight/resistance training, SAQ and speed/interval training

Time:

The duration of sessions, due to the limits of my timetable most of my sessions will be completed within one hour. Due to this I will be focusing on quality and not quantity, ensuring that all my sessions are competed to my maximum ability.

Setting Goals and Targets:

Throughout my development plan I need to set goals and targets, as my overall plan evolves around the idea of achieving the performance goal of improving acceleration and power. Performance goals are goals which relate directly to the achievement of a performance outcome. In order to achieve these outcome goals, short term and long-term goals need to be achieved throughout my development plan.

SMARTER goal setting:

SMARTER goal setting provides me with shape and a guide to my development.

Specific:
Ensuring goals are clear and concise and therefore what needs to be achieved is very obvious to the athlete. Improving acceleration and power is an example of a specific goal targeting a specific area of my game that will impact upon my overall performance.

Measurable:
Assessing goals through formal processes is important of gauge levels of improvement. If improvement is shown these goals can also motivate individuals to keep training.
In my case this will be testing after mesocycle 1, these results will allow me to critically analyse my training and adjust it in order to make further improvements. From this I will also be able to set realistic targets for improvement before my nest testing after mesocycle 2.

Agreed:
Goals should be agreed with others to ensure they are achievable, not dangerous and won't impair the athletes performance long term, I have discussed my goals with both my A level physical education teacher and one of my netball coaches in order to ensure they are appropriate and achievable.

Realistic:
This involves ensuring that goals are genuine and not beyond the scope of the performer. I need to accept that by training over a period of 8 weeks the improvements I make are likely to be of relatively small margins.

Time-bound:
Goals need to reflect upon the short and long-term objective and the progression which is going to be made over time. My development plan is over a period of 9 weeks with a rest week in-between my four week mesocycle; I know and understand the time limitations and the time periods which I have in order to achieve my targets.

Exciting:
In order for goals to be motivating they need to provide the performer with a stimulus to achieve them. The concept of improving my power and acceleration and as consequence my performance is one that excites me. As a consequence therefore I am more likely to achieve my goals as if they are targets which excites the performer the motivation levels will be higher and training will be completed with more enthusiasm, detail and importance applied, increasing efficiency.

Recorded:

Recording goals creates a pathway for development; an agreed and clear structure is more likely to motivate a performer. I am taking and recording results after my first mesocycle, this will further help to create a pathway and guide me in the possible targets I can therefore create set for the final testing once my development plan is complete. These created predictions of improvement are likely to motivate me further during the second mesocycle of training.

Warm up:

Aims of a warm up:

The main aims and objectives of my warm up before completing the training programme in my development programme is to:

- **Prepare my body physiologically and psychologically for performance:** the effectiveness of this is dependent upon how I perform the warm up and the choice of activities, how suited they are compared to the main activity I am going to undertake, the manner in which I carry it out, the time period, and my perceived success of carrying out the warm up.
- **Improve performance:** warming up will allow me to perform my training programme at my optimum level; this will lead to more chance of a successful programme and an overall gain as a result of each training session being performed to my maximal ability.
- **Reduce the risk of injury:** therefore improving my performance as will reduce the chances of me requiring rest periods as result of injury and having to work for 3 weeks in order to re-gain the fitness levels I had for everyone one week of rest required due to injury.

Stages of a warm up:

Stage 1: Initial preparation: gross motor skills and pulse-raiser:

To begin this stage skills that involve the movement of large body parts or the whole body will be used a combination of this and pulse raising activates will introduce the stress to the body in a gradual way, which reduces the risk of injury. Raising the bodies core temperature and the temperature of specific muscles encourages many physiological responses to occur, e.g. an increased heart rate and stroke volume..

Stage 2: Injury risk prevention:

Mobility exercises can be performed to reduce the risk of injury and increase flexibility through increased localised muscle elasticity. There are many different types of stretching including; static, dynamic, ballistic, proprioceptive neuromuscular facilitation (PNF).

Stage 3: Skill practice:

Involving a skill related component, this may not be applicable for me in my training programme as I am not aiming to improve a skill area of my game.

Stage 4: Sport-specific:

Including practicing specific skills and exertions similar to what will be later experienced in the main activity, for example this may involve completing a set of weights at 40% of the exertion in the main activity or running through SAQ drills at a slower pace

My warm up will vary depending upon the main form of training I am going to undertake in the session. The warm up I will undertake prior to each type of training is outlined below:

Speed, Agility Quickness:

Stage 1: Initial preparation: gross motor skills and pulse-raiser:

- jogging, approximately 5-10 minutes at a relatively slow pace depending upon the temperature and warmth of the environment

Stage 2: Injury risk prevention:

- Dynamic stretches
- Static stretches / Physio stretches

Stage 3: Skill practice:

- Not applicable

Stage 4: Sport-specific:

- Running through light sets of each drill at a slow pace, concentrating on technique and positioning etc

Speed / Interval training:

Stage 1: Initial preparation: gross motor skills and pulse-raiser:

- jogging, approximately 5-10 minutes at a relatively slow pace depending upon the temperature and warmth of the environment

Stage 2: Injury risk prevention:

- Dynamic stretches
- Static / Physio stretches

Stage 3: Skill practice:

- Not applicable

Stage 4: Sport-specific:

- Approximately six short sprints; starting slow, building up to a faster pace, then slowly returning back to a slower pace

Weight / Resistance Training:

Stage 1: Initial preparation: gross motor skills and pulse-raiser: Cross trainer or rowing machine for 5-10 minutes, depending on my body heat and the environment

Stage 2: Injury risk prevention:

- Static / Physio Stretches

Stage 3: Skill practice:

- Not Applicable

Stage 4: Sport-specific:

- One set of light weights, going through the motions of the actions that I will be completing with resistance in the main activity of the session

Stretching:

Stretching increases the elasticity of the muscle and connective tissue, increasing the range of movement at the joint. Increasing the localised temperature of the muscles and elasticity which can therefore aid performance whilst reducing the risk of injury. There are five main types of stretching:

- **Static stretching:** little moment where the stretches are held for up to thirty seconds and the muscles are stretched to a safe limit under control, they are often repeated
- **Dynamic stretching:** controlled movements which take the joints through its full range of movement, making the athlete more prepared as the stretches are more sports specific and realistic. In order to be safe the muscles and joints must be warm before this form of stretching can begin
- **Ballistic stretching:** this method uses the momentum of bouncing to stretch the muscle; this increases the risk of injury and the chances of delayed onset of muscle soreness. Ballistic stretching is specific for many sports, and in some ways rehearses some of the actions I will do whilst completing my SAQ and sprint training sessions, due to the explosive and bouncing movements. In order to be safe, the body must be fully warm before this form of stretching is completed
- **Proprioceptive neuromuscular facilitation (PNF):** an advanced form of flexibility training that is not used in a warm up, involving passive stretching and isometric contractions, increasing flexibility and muscular strength
- **Passive and Active stretching:** passive stretching involves assuming a position and holding it with another part of your body or with the assistance of a partner. Active stretching is actively stretching the muscle yourself

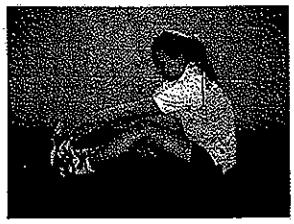
I have chosen dynamic and static stretching as my two main methods of stretching in my warm up in preparation for the main activity of training. I will complete the following stretches:

Dynamic stretches:

- Dynamic Gastrocnemius stretch, High knees, Lunges, Sums (half squat), Arm swings, Grapevine

Static / physio stretches: (with diagrams and explanations)

- Plantar fascia: Sit on floor, bend knee, place heel on the floor. Pull toes upwards:

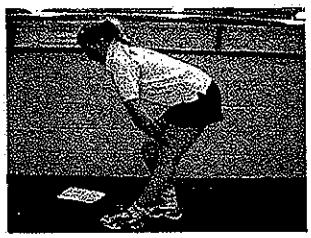


- Gastrocnemius: Stand with one leg in front of the other, place heel on the floor of behind leg, lean forward into flat wall keeping back leg straight:

- Quadriceps: Stand on one leg, pull the other leg up towards gluteus, ensure knees are together:

- Hip Flexor: One knee on floor and the other in front with a bent knee, keep back upright and push hips forward to enhance stretch:

- Hamstring (standing): One leg in front of other, bend behind leg and place weight on this leg, tilt hips forward:



- Gluteus maximums: Lie on floor on back, bring knee of one leg up towards the opposite shoulder

- Groin (standing): Stand with feet wider then shoulder width apart, transfer weight and lean towards one side of the body bending the weight bearing knee:

- Tricep: place one hand on upper back, with elbow pointing towards the ceiling, with other arm, gently push elbow back:

- Deltoid: Cross one arm across body, using the other arm pull the arm being stretched towards the opposite shoulder:

- Anterior Shoulder: Place hands together behind back, slowly lift hands upwards away from the back:

- Torso stretch: place feet shoulder width apart, twist body and arms in one direction:

<u>Short term responses that come as a result of a warm up:</u>

- Increased heart rate: due to an increase in carbon dioxide which is detected by chemo-receptors which triggers this response
- Increased stroke volume: due to greater pressure in the heart as more blood is being pumped in and out in each contraction at a greater rate, the increased pressure causes a greater elastic recoil and greater contractile force
- Increased cardiac output: increase stroke volume and heart rate results in the volume of blood being pumped from the left ventricle in one minute increasing
- Increased end-diastolic volume: the rate of filling of the heart speed up as a result of the increase in speed of the flow of blood
- Increased venous return: blood is flowing around the body at a greater rate and the contractile force of muscles is greater, pushing deoxygenated blood back towards the heart under more pressure and therefore at a faster speed

- Increased localised and core heat generation: the energy created and is given out in heat and therefore the body temperate increases
- Increased ventilation rate: quicker, deeper and more active breathing results in a greater rate of gas entering and leaving the lungs
- Increased carbon dioxide build up: as a result of an increased rate of respiration
- Increased activity of the sympathetic nervous system: the heart rate is quicken in order to release more carbon dioxide created in respiration, the anticipation of competing or training and increase hormone levels and help to active the nervous system
- Increased production, utilisation and transportation of lactic acid: the increase in carbon dioxide as a result of increased respiration results in an increase in the transport and removal of lactic acid
- Increased production of synovial fluid: the hyaline cartilage excretes a large amount of synovial fluid as a response, lubricating the joint and reducing stiffness, increasing the range of movement available at the joints
- Increased production and release of adrenaline: contributes to increased heart rate, the fight or flight scenario results in an increase in adrenaline
- Increased muscle elasticity: an increase in heat (due to energy production) results in greater elasticity resulting in greater range of movement at the joint and within the muscle tissue
- Increased speed nerves impulses: the increased temperature of the body increases the efficiency of the biochemical reactions that happen in the body, the speed of thought and neuromuscular contraction speed increases
- Vasodilatation and some blood vessels: allowing a greater flow of blood to the areas which require oxygenated blood, e.g. muscle tissue
- Vasoconstriction of some blood vessels: reduces the flow of blood to areas which do not require a great amount during exercise, e.g. organs
- Vascular shunting: vasodilatation and vasoconstriction results in a greater proportion of blood flowing to parts of the body where there is a higher demand for oxygenated blood
- Decrease in end-systolic volume: greater contractile force results in a greater amount of blood leaving the heart after each contraction
- Thermoregulation begins: the body begins to keep the temperature between certain boundaries so it does not reach extremities of hypothermia or hyperthermia, part of the process of homeostasis
- Localised muscular metabolism speeds up:
- Dilation of capillaries

- Reduced muscle viscosity

The intensity and duration of warm ups:

I need to work at an intensity that will bring about the responses mentioned above so that I can train at my optimum performance and the positive adaptations of my training will be greater. When my warm up objectives have been achieved and I am both physically and psychologically prepared for the activity I am ready to undertake, I will be able to start the activity of my training session.

Cool down And Recovery:

My cool down should help to speed up recovery by performing light, continuous exercise to keep the heart rate elevated.

Purpose of my cool down:

- Keep metabolic activity high
- Keep capillaries dilated: so oxygen can be flushed through the muscle tissue, removing and oxidising any remaining lactic aced
- Prevent blood pooling in veins: avoid causing dizziness
- Bring the heart rate down back to resting rate slowly

How long should the cool down be?

It should last for a relative period of time, depending on the type and intensity of the activity which I have just undertaken. The heart rate is a good indicator of the duration that is required until the cool down is complete.

Stages of the cool down:

- **Decreasing heart rate:** the heart rate should be gradually decreased through slow jogging, swimming, cycling etc
- **Series of stretches:** a period of stretching exercises should facilitate and improve the elasticity of the muscles (as they are still warm)

My cool down:

After I complete my SAQ and sprint/interval training sessions I will cool down by:

- Jogging for approximately 3-5 minutes, gradually decreasing pace, until I feel my pulse has returned to a similar level of beats per minutes as it is at rest
- Complete a series of static stretches as shown in the diagrams above (in the warm up section) including my physio exercise stretches

After completing my weight/resistance training sessions I will cool down by:

- Complete a series of static stretches as shown in the diagrams above (in the warm up section) including my physio exercise stretches

I don't believe that will be a large need for me to complete a pulse decreasing exercise as the activity I am completing in my main session does not require large aerobic or anaerobic exertion and I will be having recovering time between each set, therefore my pulse should not be constantly raised after weights / resistance training and my body will not need to reduce the heart rate.

Lactic acid removal:

More than half the exercise-induced lactic acid is removed within 15 minutes after exercise, and the rest within approximately an hour. Elevated heart and ventilation rates are therefore required for functions other than the removal of lactic acid.

Increased temperature, growth and repair tissues, reloading of energy stores and myoglobin all require oxygen. Respiratory and cardiac muscles will also be working harder along with the heart requiring more oxygen, tissue repair and then redistribution of calcium ions which both require energy and oxygen. Meaning heart and ventilation rates are required to stay elevated

Restoration of ATP, PC and glycogen stores post-exercise:

Post-exercise window for replenishment, fatty foods and simple sugars can be consume during this period to be converted and used in the process of replenishing ATP, PC and glycogen stores. Replenishment is quicker when complex carbohydrates have been consumed, i.e. the better the quality of carbohydrate digested within the shortest period of time possible the quicker the recovery.

Therefore after completing my individual training sessions I may intake a form of complex carbohydrate, for example a banana to aid the restoration of energy stores and therefore allow me to recover at a greater rate.

Excess post-exercise oxygen consumption (EPOC):

Relates to the elevation of ventilation and heart rate after exercise when compared with previous levels before exercise, repaying oxygen debt. When only a lack of ATP can be produced aerobically, glycolysis will take over as the predominant method of ATP supply resulting in depletion of muscle glycogen and a production of lactic acid. Therefore at some point, when the ATP production through the anaerobic energy system is used up and exercise must stop.

Delayed-onset of muscle soreness (DOMS):

Can be caused by excessive mechanical forces being applied to muscle and connective tissue resulting in muscle soreness the following day, or in later stages of the exercise session. The result of eccentric work, and therefore specifically during my SAQ sessions I will need to be aware of the potential implications on my body and the recovery required.

I can minimise DOMS by:

- Building my training intensity gradually
- Cross training: by completing sessions of SAQ, sprint/interval training and weight/resistance training

Recovery:

The time required for recovery is dependant on the level of stress experienced by the body. Therefore my recovery from each training sessions will vary depending upon the intensity and lengths of the sessions in addition to my current health and tiredness.

There are two main phases to recovery:

- **Fast component:** concerned with the phosphagen stores. Phosphagens are energy storage compounds which are mainly found in muscle tissue, PC and ATP. The restoration process takes up to about four minutes, a portion of oxygen used to resynthesise and restore muscle phosphagen stores (ATP and PC) which I will exhaust during my training sessions. The process is rapid and achieved by mainly the aerobic energy system. Scientifically this process involves the use of three main mechanisms; the use of energy from the aerobic conversion of carbohydrate into carbon dioxide and water- used to manufacture ATP form ADP and PC. Some ATP is then immediately utilised to create PC trough the use of a two phase reaction with the first phase providing ADP a Phosphate molecule and energy, and the second converting these products into phosphocreatine. The third mechanism makes a small percentage of ATP which is derived from the production of lactic acid available for phosphagen replenishment.

- **Slow component:** Heat dissipation, energy replenishment, rehydration and the removal of lactic acid are involved in this process. Therefore it is important for me to keep warm, refuel my body and rehydrate my body after training.

Ergogenic acids:

Any external influences that can positively affect physical or mental performance; mechanical, pharmacological, physiological and nutritional.

Ice baths

Popular in contact sports, and as my training programme is individual with minimum contact they should not need to be used to benefit time, however they may be useful after hard training sessions e.g. SAQ for the following reasons:

- Immersion allows controlled even constriction around muscles, closing microscopic damage that cannot be felt, and numbing pain

- physiological reaction provoked by the amount of muscle submerged, body fights back from shock or rapid cold emersion by sending a blood rush that flushes the damage-inflicting waste from your system

There usefulness for me in aiding recovery, is how restricted by the practicality, as the opportunity to have an ice bath after my training sessions is limited

Compression clothing:

For example elastic shorts, tights and vest

The confirmed benefits that I could gain from wearing compression clothing include:

- better muscular alignment and structure

- reduced muscle damage

- improved circulation

- increased awareness of muscle operation
- increase in anaerobic threshold, power and endurance
- Reduce sweat rate by 30%
- Improve performance by reducing the impact of hot / humid conditions on the body's thermoregulatory system, however as my programme is taking place in the winter months when conditions are not warm, this will not be applicable to me as an individual

Diet and Fuelling for my Training:

To ensure my performance in my training sessions I need to successfully adjust my diet to meet the demands. Diet is extremely important to and athlete and it can underpin performance. I will need to consider and manipulate my diet to allow me to; consume adequate volumes and types food to facility my training and recovery processes, ensure energy stores are full before and replenished straight after training sessions, hydrate my body adequately, remain healthy with a strong immune system. In doing this I will be best preparing myself to complete training sessions to the required intensity and standard and therefore improve my long term performance.

There are seven main food groups: Carbohydrates, proteins and fats are 'energy providers'(macronutrients), where as vitamins, minerals (micronutrients), water and fibre are considered 'non-energy providers'.

Carbohydrates:

Carbohydrates are a critical fuel source for the muscle and central nervous system, and therefore the availability of carbohydrate plays a key role in the performance of exercise.

This includes food such as, pasta, rice, bread, cereal, grains and potatoes. It is the major energy source of the body. Glucose is the basic usable form of carbohydrates in the body, being used directly by the cell for energy, stored as glycogen in the muscle and liver, or converted to fat as an energy store. If the body does not need the glucose then it is converted into fatty acids and glycerol, and stored as triglycerides in adipose tissue and skeletal muscle.

There are three types of carbohydrate; monosaccharides, disaccharides, polysaccharides. Monosaccharides are single molecules; glucose, fructose and galactose e.g. fruit. Disaccharides consists of two molecules together; sucrose and maltose e.g. sweets. Polysaccharides consist of many units of glucose; glycogen and starch e.g. bread. The grams of carbohydrate in some medium portions of food are shown in the table below:

It is recommended that you consume 7-10g of carbohydrate per kilogram of body weight per day. I weigh approximately 67kg so therefore it would be recommended for me to consume 469g of carbohydrate per day, I will not be able to accurately measure and consumer these each day but will adjust my diet during my development to consumer approximately 500g per day. It is hard to consume the exact amount, however the table below provides a list of portions of food providing 50g of carbohydrate, which I can use and calculate the amount consumed per day:

Food:	**Portion per 50g of carbohydrate:**
Weet-bix	60g (5 biscuits)
Cornflakes	60g (2 cups)
Porridge – made with milk	350g (1.3 cups)
Bread	100g (4 slice of white)

Muesli bar	2.5
Fruit filled biscuits	5
Pancakes	150g (2 medium)
Ice fruit bun	105g (1.5)
Boiled rice	180g (1 cup)
Pasta or noodles, boiled	200g (1.3 cups)
Bananas	2 medium-large
Orange, apple etc	3-4
Dried apricots	115g (22 halves)
Potatoes	350g (I very large, or 3 medium)
Sweet potato	350g (2.5 cups)
Baked beans	440g (I large can)
Milk	I litre
Flavoured milk	560ml
Flavoured non-fat yoghurt	350g (2 individual tubs)
Ice cream	250g (10 Tbsp)
Rice pudding	300g (1.5 cups)
Chocolate	80g
Jelly babies	60g
Pizza	300g (medium-1/3)
Lasagne	400g serve
Fried rice	200g (1.3 cups)
Fruit juice	500ml
Cordial	800ml
Sports drink	700ml
Sports gels	2 sachets

Liquid meal supplement	250-300ml

The Glycemic Index is a ranking of the breakdown of carbohydrates into sugars and the time it takes to enter the blood stream, from 0-100, the lower the number the slower the digestion rate. A figure above 70 is generally accepted as high GI, moderate GI is the value between 50-70 and below 50 is considered low GI. I need to take the glycemic index of foods into account when selecting my foods for recovery and to fuel my training, as it is important I am releasing the right amount of carbohydrates (energy) into my body at the right time.

The table below shows some examples of foods that are high, moderate of low GI:

High GI	**Moderate GI**	**Low GI**
Glucose	Sucrose	Fructose
Honey	Mars Bars	Chocolate
Jelly beans	Crisps	Sponge cake
Sports drink	Squash	Milk
Bagel	Bread	Fruit cake
Weet-bix	Muesli	All-Bran
White rice	Brown rice	Pasta
Baked potato	Boiled potato	Baked beans
Water melon	Banana	Apple
Parsnip	Sweet corn	Lentils

I am aware and understand the concept and reasons behind carbohydrate loading; this process can be beneficial to athlete before a big event, however as my development plan lasts for 8 weeks, revolves around training and not one 'big event' it is not feasible or appropriate to apply this principle to my training programme.

<u>Proteins:</u>

These are important for growth and repair and also provide energy for extreme cases, however these stores are last resort energy provider. Amino acids are the basic structural unit of proteins, foods that are rich in amino acids (and therefore I need to consume during my development plan) include animal's protein and milk, cereal, cheese, fish, lean meat and liver. Structural proteins are needed to build connective tissue, cell membranes and muscle cells. Regular proteins act as enzymes and as a form or transport. There are 20 different amino acids, though in the body we can't make

the nine essential ones, therefore it is important to consume these foods during my training programme, especially as some are used as a minor fuel source during physical activity.

There is research to support the fact that adolescents have additional protein requirements, and that there is a slight increase in the requirement for athletes.

The estimated protein requirements, according to the Australian Institute of Sport are show in the table below:

Group	Protein intake (grams per kilogram of body weight per day)
Sedentary men and women	0.8-1.0
Elite male endurance athletes	1.6
Moderate-intensity endurance athletes	1.2
Power sports e.g. rugby. Australian rules football	1.4-1.7
Resistance athletes (early training)	1.5-1.7
Resistance athletes (steady state)	1.0-1.2
Female athletes	-15% lower than male athletes

As I am completing a training programme including power, and resistance training (early stages) I need to consume approximately 1.1 grams of protein, per kilogram per day to sufficiently meet the demands. As I weigh approximately 67kg I need to consume approximately 73g of protein per day. It is important for me to consumer enough protein regularly as insufficient protein may cause muscle to be broken down to ensure supply of amino acids to the body, leading to a loss of strength and power (aspects which I am trying to improve) in addition to general negative effects upon training performance.

I will get my protein from sources of protein rich food. The table below includes some forms of this which provides approximately 10g of protein:

Food:	**Portion per 10g of protein:**
Small eggs	2
Reduce fat cheese	30g
Low fat milk	250ml
Lean chicken	40g
Grilled fish	50g

Canned tuna	50g
Reduced fat yoghurt	200g
Wholemeal bread	2 slices (120g)
Wholegrain cereal	3 cups (90g)
Cooked pasta	2 cups (330g)
Cooked rice	3 cups (400g)
Baked beans	200g

The timing of the consumption of protein is important but can also be difficult for an athlete to perform correctly. The importance of protein for recovery is important, and muscle and body protein metabolism, is a contact balance between protein break down and rebuilding, during training the balance will be towards protein breakdown and during recovery and protein consumed the balance tips towards protein rebuilding. Research suggests that the effects of post-exercise protein intake after exercise are best if the protein is consumed with a form of carbohydrate, due to its insulin stimulating ability encouraging the muscles to take up amino acids, for example flavoured yoghurt, a milk drink or cereal bar.

Fats:

Fat provides insulation and protection to vital organs such as the heart lungs etc and helps transports vitamins throughout the body. It also provides the body with energy in the later stages of aerobic activity for example marathon runners are reliant upon the complete combustion of fats to glucose to provide them with energy to complete the race once their glycogen have been depleted.

Are present in the body as triglycerides, fatty acids and cholesterol. Basic structure of triglycerides; one molecule of glycerol and three molecules of fatty acids. A free fatty acids that has its carbons saturates with hydrogen is known as 'saturated', a large amount of these can lead to high blood pressure and cholesterol levels, therefore I need to avoid consuming these in great amounts. Unsaturated fats don't have their carbon atoms saturated with hydrogen, these are liquid at room temperature for example vegetable oils – I should consumer a greater amount of these then saturated fats to make up my intake as they are healthier in the long term for my body.

There are two forms of fats available to the muscles during exercise; free fatty acids (from adipose tissues) and triglycerides (within muscle cells). The speed of the synthesis and breakdown of fats is dependant upon the concentration of fatty acids, determined by mainly the uptake of free fatty acids and triglycerides. During low energy production (when I am not being active) the supply of fatty acids consumed will lead to an increase in fatty acid concentration in the cell. When energy requirement increasing (active, e.g. in a training session) the stored fatty acids will be used in energy production, resulting in a decrease in fatty acid concentration, then stimulating the break down of triglycerides into glycerol and free fatty acids to compensate, this process is caused by hormones.

As my development programme is focused largely around anaerobic training, the amount of fat I need to intake will be smaller compare to the amounts of protein and carbohydrates as the conversion rates of fats to glucose is not quick enough to provide energy in short bursts of intense anaerobic activity.

Minerals:

These provide the structure for forming bone and teeth. The also assist with muscular contraction, maintaining the normal rhythm of the heart and control the acid-base levels, which effects enzyme activity, vital to many of the body systems and processes.

Sodium, calcium, phosphorous, potassium, iron and magnesium are amongst the many minerals that are required in small amounts per day, the above are considered more vital and can have a greater effect on performance if the right amounts are not consumed at the right time.

Calcium is important and is require for muscle contraction, blood vessel expansion and contraction, secretion of hormones and enzymes and the transmission of nervous impulses. It is ideal for the body to maintain a concentration of calcium in the blood, muscle and intercellular fluids, however most of the body's calcium supply is stored in the bones and teeth. The recommended intake per day for a female between the ages of 14-18 is 1300mg. The table below shows the amounts in certain amounts of food:

Food	**Mg of calcium contained:**
Plain, low fat yoghurt, 230g	415
Cheddar cheese, 42g	306
Semi-skimmed milk, 230g	297
Orange juice, 170g	200
Vanilla ice cream, ½ cup	85
Sour cream, 2 tablespoons	32
Tortilla wrap	37

Sodium helps to maintain the water balance in cells and the function of nervous impulses and muscles as well as influencing the acid-base levels to maintain normal cellular activities. Sodium is lost is sweat and it is vital to replace it. Sports drinks containing electrolytes are often consumed to replace they minerals which are excreted during exercise. The recommended sodium amounts for males is 110mg and females 330mg.

Iron is particular important as it is required for key functions in the body; it is an important component of haemoglobin and myoglobin, which transport oxygen in the blood and muscles. It is also involved in the electron transport system, and therefore the production and release of ATP, it is required for red blood cell production and a healthy immune system. It is important to someone completing high levels of training as it can impair aerobic metabolism through the decreased rate of delivery of oxygen to the muscles, and therefore the ability for the athlete to work at intensity for long periods of time.

Iron an important mineral and is required as the body is unable to manufacture iron, iron is distributed in the food we eat; however some sources provide greater amounts the others. Iron absorption max is (15-18%) in foods that contain haem iron, absorption from foods which contain non-haem iron is lower (5%) sources and amounts of both are outlined in the table below:

Food – heam iron	**Serve**	**Iron (mg)**
Liver	10g cooked	11.0
Beef	100g cooked	4.0
Chicken	100g cooked	1.2
Fish	100g cooked	0.6-1.4
Salmon	100g	1.5
Food – non heam iron		
Eggs	100g	2.0
Breakfast cereal	30g (1 cup)	2.5
Sultanas	50g	0.9
Dried apricots	50g	2.0
Wholemeal bread	60 g (slices)	1.4

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The following table provides the recommended daily intake of Iron:

Age	Males	Females
9-13years	8mg/day	8mg/day
14-18years	11mg/day	15mg/day
19-50years	8mg/day	18mg/day

However during my development plan my needs for iron will increase further as I will have high requirements of Iron. The need is higher during growth, as an increased red blood cell mass results in higher needs training should increase my red blood cell mass. I will have increased looses of iron due to loss in sweat and impact (from mechanical trauma from both contact with the floor due to running, bounding, jumping etc, and collisions during matches with other players and the floor) resulting in increased red blood cell destruction.

Vitamins:

There are 13 different vitamins that have been identified, which together are responsible for blood clotting, neuromuscular function, healthy teeth and bones, healthy skin and numerous bodily functions.

Fat soluble vitamins, A, D, E and K are absorbed with fat from the intestine into the circulatory system, where they are carried to the liver and stored. Vitamin E is distributed in the body's fatty tissues

Water soluble vitamins, B and C are stored in the body's fat tissue for very short periods before they are excreted by the kidneys, they therefore need to be consumed daily. Vitamin B12 is an exception to this and is stored in the liver.

Vitamin:	**Sources:**	**Use and results of deficiency:**
A	Dairy products, eggs, liver, green vegetables and carrots	Maintain health of the epithelium, aids retinas dark adaption ability
B1 (thiamine)	Yeast, egg yolk, liver, wheat-germ, nuts, red meat, cereals	Carbohydrate metabolism Irritability, loss of appetitive
B2 (riboflavin)	Dairy product, liver, vegetables, eggs, cereals, fruit, yeast	Intercellular metabolism Chapped lips
B12	Liver, red meat, dairy products, fish	Manufacture of genetic material in cells
C	Green vegetables, fruit	Maintenance of bones, teeth and gums, ligaments and blood

		vessels. Immune response
D	Fish liver oils, Dairy	Role in absorption of calcium, aiding healthy bones
E	Vegetable oils, wheat-germ, wholemeal bread /cereals, egg yoke, nuts, sunflower seeds	Damage protection, promotion of normal growth and development, aids normal red blood cell formation Deficient can lead to muscular dystrophy
K	Green vegetables	Used by the liver

Vitamins do not provide the body with energy but they help to regulate metabolic reactions and energy release. They again can't be made in the body and must be consumed for reasons outlined in the table above. However I must be carefully no to over-consume minerals, particularly fat soluble ones as they can be harmful to health. Below is a table of the recommend daily amounts by the National Health Service for both men and women:

Vitamin	**Men**	**Women**
A	0.7mg	0.6mg
B1	1.0mg	0/8mg
B2	1.3mg	1.1mg
B6	1.4g	1.2mg
B12	0.002mg	0.002mg
C	40mg	40mg
D	0.01mg	0.01mg
E	10mg	8mg
K	0.8mg	0.06mg

Exercise increases the production of free radicals, which increases the potential for cellular damage to substances involved in biological processes. This is however not of great concern as research indicates that the body's natural defences are adequate to cope with the increased amounts of free radicals that come about as a result of exercise. Vitamin E may be a supplement which aids the body in combating free radicals, and therefore I will consume recommended amounts of this during my development plan.

Vitamins and minerals can complement each other and enhance each other's absorption and function, therefore my diet during my development plan should include a good balance of both vitamins and minerals.

Fibre:

Though fibre does not provide the body with energy or any nutrients, it is vital to every diet. It aids the digestive system to process food and absorb nutrient, It also lowers blood cholesterol and helps control blood sugar levels. It is recommended that approximately 18g of fibre is consumed per day. A few sources of fibre, some sources of both soluble and insoluble fibre are shown in the table below:

Insoluble	**Soluble**
Beans	Apples
Oats	Pears
Wholegrain bread / cereal	Strawberries

Water and hydration:

Water is essential for any diet, drinking the right amount and fluid is extremely important and can have a huge effect upon performance. It is the single most important nutrient to an athlete, the following table found in the Edexcel A2 PE textbook, shows the effects of water loss:

Body weight loss as sweat (%)	**Physiological effect**	**Performance effect**
1		Loss of 5%
2	Impaired performance	Loss of 10%
4	Capacity for muscular work declines	Loss of 25%
5	Heat exhaustion	Potential failure to complete
7	Hallucinations	Potentially fatal
10	Circulatory collapse and heat stroke	Potentially fatal

Though loss of water through sweat contributes to these negative effects, the loss of electrolytes also plays a large role in the negative effects upon a performer of dehydration. An athlete should always try and avoid becoming 'dehydrated' and a clear early sign of dehydration is thirst, the rate at which is absorb fluids is lower than the rate you lose them, therefore once you are dehydrated during an event, training session etc, you won't be dull hydrated again until you stop exercising.

The amount of fluid lost during exercise and therefore the amount that needs to be replaced can be calculated using body weight. Weighing and recording weight before and after the physical activity will allow the weight difference to be calculated. The weighing process should be done with no clothes on as they hold sweat. The difference in kg can then be translated into litres as a 1 kg loss is weight is approximately equivalent to 1 litre of fluid e.g. if I lost 1.2kg I would need to drink 1.2 litres of fluid .

Water is not the best substance to rehydrate with, it cause bloating and suppresses thirst, as well as stimulating urine output. It also contains no carbohydrate or electrolytes which are also lost during exercise in the form of sweat.

Drinks containing electrolytes will reduce urine output and enable fluid to empty quickly from the stomach, promote absorption from the intestine and encourage retention. Therefore it speeds up the rate at which fluid gets into the body. The replacement of electrolytes and glucose is vital to a sports performer and sports drinks can provide this. The consumption of carbohydrate in fluid before, during and after exercise will have to prevent blood glucose levels falling and aid the maintenance of the body's glycogen stores. Glycogen stores are depleted during high intensity anaerobic exercise, therefore it may be a good idea for me to consume a hypertonic sports drink after some training sessions to replace my stores and allow for a quicker more effective recovery.

There are three types of sport drink, are categorised by the levels of fluid, electrolytes and carbohydrates or their 'osmality' of their components. They are summarised in the following table:

Type	**Content**	**Glucose content (volume)**
Isotonic	Fluid, electrolytes and 6-8% carbohydrate	Similar to blood of the body
Hypotonic	Fluids, electrolytes and a low level of carbohydrate	Less than blood or the body
Hypertonic	High level of carbohydrate	Greater than blood / body

I need to keep constantly hydrated during my exercise programme, and will do so mainly through a combination of water and sports drinks, in addition to this milk (providing calcium and protein) and fruit juice (vitamins) will be consumed. Getting fluid intake levels correct may contribute greatly to the success of my training programme as the body's hydration levels impact upon performance levels and in order for my programme to be successful I need to be able to perform at an optimum level each training session.

<u>How does what I consume provide me with energy and the substances required to train and recover?</u>

ATP is the only usable form of energy in the body, and therefore it is required to convert carbohydrate, fat and protein (energy sources) into adenosine triphosphate to fuel muscular contraction.

There are three mechanisms that the body used to convert stored energy to ATP:

- The aerobic energy system-aerobic
- The ATP-PC system (the alactic energy system) -anaerobic
- The lactic acid system - anaerobic

The storage and release of energy:

Glycogen is made up of chain of glucose molecules and during glycolysis glycogen molecules are broken down in both aerobic and anaerobic activity. The glucose molecules are removed and released into the bloodstream or muscle cells where they are further broken down to release energy. Glucose from fats and carbohydrate in the bloodstream can be sent directly to the muscles for the release of energy, converted into glycogen for storage in the muscles or liver, converted into lipids and stored as fats. If the body does not need the glucose at that current time, it enters the fat metabolic system where it is converted into fatty acids and glycerol and store in the body as triglycerides in adipose tissue and skeletal muscle. When energy is next require from fat reserves the triglycerides are broken down into glycerol and fatty acids then transported to the lived where they are converted into glucose.

The majority of the body's glycogen is stored in the liver, and the remaining is stored in the muscles. Therefore a function of the liver is to convert glycogen into glucose when it is required for energy production. Both adrenaline and glycogen are involved in this process: Adrenaline is secreted by the adrenal glands and promotes the conversion of fats into glucose for use as an immediate energy source. glycogen promotes the conversion of fats and glycogen into glucose, which is then utilised by the body when blood sugar levels are low.

Carbohydrate is the most effective source of high intensity as it requires less oxygen to be brunt then protein or fat, though fat provides a high yield of ATP once oxidised. The table below shows the usage of fats, carbohydrates and proteins and how they are dependant on the intensity and duration of exercise:

Energy source:	Main functions:	Used as energy fuel when:
Carbohydrates	- High intensity energy	Intensity of exercise is at a level that can't be sustained through metabolism of fats in the aerobic energy system
Fats	- Low-intensity fuel - Insulation	Intensity of exercise is at a medium to low level and energy requirements can be met through metabolisation of fats in the aerobic energy system
Proteins	- Muscle tissue growth	The athlete has eaten a very

	- Muscle tissue repair - Energy	low-carbohydrate diet or is experiencing a famine, or towards the end of an ultra distance event

The normal stores of carbohydrate in a typical 60kg female athlete are; liver glycogen 70g, and muscle glycogen 300g. During hard exercise, carbohydrate can be depleted at a rate of 3-4g per minute and 24-48 hours are required for the body to fully recover the muscle and liver glycogen stores. This may be significant to me during my development plan as the majority of my training consists of high intensity anaerobic exercise, and therefore these lost carbohydrates will need to be replaced. Fats are found in the body in the forms of triglycerides, phospholipids and cholesterol

Testing:

I will complete the 'flying 30m sprint' test (speed), the vertical / sergeant jump test (power), 10m sprint (acceleration). I will also record body fat percentage and weight. I will complete these tests three times to find an average score to make them more reliable and valid. I will complete them before and after completing my programme, and at a period of 4 weeks to test my improvement and effectiveness of the programme:

1. I will test at the **beginning** of my development plan, to test my initial speed, acceleration and power
2. I will test at the **intermediate** interval (4 weeks) to determine the effectiveness of my progressive overload, development plan and gauge how I need to alter my future meso-cycles in order to achieve the maximum results from my programme
3. I will test **finally** at the end to see my overall effectiveness of my development plan and the improvement I have made. These results can then be directly compared with my other sets of test results to see how I progressed over the programme and I can evaluate the success of my development plan

Flying 30m sprint: Mark out a 50m straight run on a non slippery surface and place a 'timing start' – start of the flying 30m) line. From a stationary position sprint to the whole 40m at maximum pace. The time recorded will be the time it takes from the 10m line to the end of the 40m. Reaction time is not taken into account (and to an extent neither is acceleration) and therefore it is a fairer test of 'speed' then a tests which is a reaction to a stimulus from a stationary position. Below are the national norms for 16 to 19 year olds.

Gender	Excellent	Above Average	Average	Below Average	Poor
Male	<4.0	4.2 - 4.0	4.4 – 4.3	4.6 – 4.5	>4.6
Female	<4.5	4.6 - 4.5	4.8 – 4.7	5.0 – 4.9	>5.0

Vertical (sergeant) Jump: requires the individual to stand side on to wall or vertical object with a measuring device, with both feet on the ground their maximum stretch (the tips of fingers) should be measured. Once this has been measured the athlete should jump as high as possible and the height which they reached should then be recorded. Below are the normalities for 16-19 year olds:

Gender	Excellent	Above Average	Average	Below Average	Poor
Male	>65 cm	50 - 65 cm	40 – 49 cm	30 – 49 cm	<30 cm
Female	>58 cm	47 – 58 cm	36 – 46 cm	26 – 35 cm	<26 cm

10m sprint: A 10m straight run should be marked out on a non slippery surface, start in a stationary position and sprint at maximum pace to the 10m line. The timing should commence at the start of the 10m and end at the 10m line. Human error will need to be taken into account with regards to the accuracy of timing.

Body Fat Percentage: This test measures the percentage of body weight which is fat tissue, though the skin callipers and method can often produce results which are not entirely accurate it provides a good rough idea of the levels of body fat. Though this is not an area which I am to improve or that my development plan should bring about changes to, testing my body fat levels at the start and the end of my programme will provide me with information about the success of my diet and the gain of muscle mass as a result of weight / resistance training. The average body fat percentage for females is between 18% and 22% and the typical value for elite female athletes is between 12% and 20%.

Weight: I will weigh myself at the beginning and then end of my development plan in order to see how my training has affected my body weight, this combined with the use of body fat % will indicate whether or not I have gained lean muscle mass.

Accuracy and Validity of results:

During the completion of my testing I will attempt to ensure that my results are as accurate as possible and are therefore valid and show accuracy regarding the effects of my development plan on my levels of speed, acceleration and power.

With regard to my test results from the 'flying 30m' and '10m sprint' I accept that human error is likely to play a role in the accuracy of my results. Therefore in order to account for human error related to timing issues a value of +/- 0.5 seconds needs to be accepted as a standard deviation from the recorded results.

PERFORMING & RECORDING

Periodisation:

Periodisation is an organised approach to training that involves progressive cycling of various aspects of a training programme over a specific period. By splitting training into periods in order to focus better on specific objectives

The macrocycle is the entire period of time, during which I will set clear and specific objectives, e.g. improve my speed / acceleration

The macrocycle is split into block called mesocycles; each mesocycles will have objectives, which when achieved contribute to the overall objectives of the macrocycle

Mesocycles are split into smaller cycles called microcycles. Individual or linked training sessions, these sessions will contribute towards the objectives of the current mesocycles

For an athlete a macrocycle may be a period of 4 years, for example a current Olympic athlete is likely to have been planning their training preparation for 2012 since the Beijing Olympics. However as my development plan will take place over approximately 9 weeks my cycles will be as follows:

Macrocycle: 9 weeks

Mesocycles: 4 weeks, 1 week, 4 weeks,

Microcycles: 2 weeks

<table>
<tr><td colspan="8">Macrocycle: 9 weeks 18th (January – 22nd March)</td></tr>
<tr><td colspan="4">Mesocycle 1: 4 weeks (18th January-14th February)</td><td>*</td><td colspan="3">Mesocycle 2: 4 weeks (22nd February – 21st March)</td></tr>
<tr><td colspan="2">Microcycle 1: 2 weeks (18th -31st January)</td><td colspan="2">Microcycle 2: 2 weeks (1st-14th February)</td><td>*</td><td colspan="2">Microcycle 3: 2 weeks (22nd February- 7th March)</td><td colspan="2">Microcycle 4: 2 weeks (8th-21st March)</td></tr>
<tr><td>18th -24th January</td><td>24th -31st January</td><td>1st -7th February</td><td>8th - 14th February</td><td>*</td><td>22nd – 28th Februar y</td><td>1st – 7th March</td><td>8th – 14th March</td><td>15th – 21tst March</td></tr>
</table>

* Transition period between mesocycles 1 and 2 (15-21st February)

Microcycle 1:

18th - 24th January: school week 2

24th -31st January: school week 1

Microcycle 2:

1st -7th February: school week 2

8th -14th February: school week 1

Microcycle 3:

22nd – 28th February: school week 2

1st – 7th March: school week 1

Microcycle 4:

8th – 14th March: school week 2

15th – 21tst March: school week 1

Final testing:

22nd-28th March: school week 2

Timetable – Mesocycle 1, Microcycle 1

WEEK ONE	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
1	LESSONS	LESSONS	LESSONS	METTING MR ETTINGER 9.00	LESSONS		-
2	LESSONS	LESSONS	LESSONS	LESSONS	FREE POSSIBLE TRAINING TIME – (WEIGHTS OR SPRINT TRAINING)		
BREAK							
3	LESSONS	FREE DEVELOPMENT PLAN – SAQ, SPORTS HALL	FREE	LESSONS	FREE POSSIBLE TRAINING TIME – (WEIGHTS OR SPRINT TRAINING)	POLY LEAGUE SERNIOR NETBALL MATCH (some weeks)	SOUTH REGIONAL U19 NETBALL MATCH (most weeks)
LUNCH							
4	FREE POSSIBLE TRAINING TIME – (WEIGHTS OR SPRINT TRAINING)	LESSONS	NETBALL	LESSONS	LESSONS P.E PRACTICAL DEVELOPMENT PLAN – SPRINT TRAINING, ASTRO		
5	NETBALL	LESSONS	NETBALL	FREE POSSIBLE TRAINING TIME – (WEIGHTS OR SPRINT TRAINING)	FREE POSSIBLE TRAINING TIME – (WEIGHTS OR SPRINT TRAINING)		
BREAK	NETBALL		NETBALL				
6	NETBALL	FREE DEVELOPMENT PLAN – WEIGHTS, GYM	NETBALL	FREE DEVELOPMENT PLAN – SAQ SPORTS HALL	SPORTS ACADEMY		
AFTER SCHOOL	PHYSIO EXERCISES	POSSIBLE TRAINING TIME – SAQ PHYSIO EXERCISES	NETBALL 7-10	PHYSIO EXERCISES	PHYSIO EXERCISES	PHYSIO EXERCISES	PHYSIO EXERCISES

Timetable – Mesocycle 1, Microcycle 1

WEEK TWO	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
1	**LESSONS**	**LESSONS**	**LESSONS**	**LESSONS**	**LESSONS**	POLY LEAGUE SERNIOR NETBALL MATCH (some weeks)	SOUTH REGIONAL U19 NETBALL MATCH (most weeks)
2	**FREE DEVELOPMENT PLAN – SPRINT TRAINING, ASTRO**	**LESSONS**	**FREE**	**LESSONS**	**FREE POSSIBLE TRAINING TIME – (WEIGHTS OR SPRINT TRAINING)**		
BREAK							
3		**FREE POSSIBLE TRAINING TIME – (WEIGHTS OR SPRINT TRAINING)**	**LESSONS**	**LESSONS**	**LESSONS**		
LUNCH							
4	**LESSONS**	**LESSONS**	NETBALL	**FREE POSSIBLE TRAINING TIME – (WEIGHTS OR SPRINT TRAINING)**	**FREE DEVELOPMENT PLAN – WEIGHTS, GYM**		
5	NETBALL	**LESSONS**	NETBALL	**LESSONS** P.E PRACTICAL **DEVELOPMENT PLAN – SAQ SPORTS HALL**	**LESSONS**		
BREAK							
6	NETBALL	**FREE DEVELOPMENT PLAN – WEIGHTS, GYM**	NETBALL	**LESSONS**	SPORTS ACADEMY		
AFTER SCHOOL	PHYSIO EXERCISES	**POSSIBLE TRAINING TIME – SAQ** PHYSIO EXERCISES	NETBALL 7-10	PHYSIO EXERCISES	PHYSIO EXERCISES	PHYSIO EXERCISES	PHYSIO EXERCISES

Timetable Mesocycle 1, Microcycle 2. Mesocycle 2, Microcycle 3 & 4

WEEK ONE	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
1	LESSONS	LESSONS	LESSONS	METTING MR ETTINGER 9.00	LESSONS	POLY LEAGUE SERNIOR NETBALL MATCH (some weeks)	SOUTH REGIONAL U19 NETBALL MATCH (most weeks)
2	LESSONS	LESSONS	LESSONS	LESSONS	FREE POSSIBLE TRAINING TIME – WEIGHTS		
BREAK							
3	LESSONS	FREE DEVELOPMENT PLAN – SAQ, SPORTS HALL	FREE	LESSONS	FREE POSSIBLE TRAINING TIME – WEIGHTS		
LUNCH							
4	FREE POSSIBLE TRAINING TIME – WEIGHTS	LESSONS	NETBALL	LESSONS	LESSONS P.E PRACTICAL DEVELOPMENT PLAN – WEIGHTS, GYM		
5	NETBALL	LESSONS	NETBALL	FREE POSSIBLE TRAINING TIME – WEIGHTS	FREE POSSIBLE TRAINING TIME – WEIGHTS		
BREAK	NETBALL		NETBALL				
6	NETBALL	FREE DEVELOPMENT PLAN – WEIGHTS, GYM	NETBALL	FREE DEVELOPMENT PLAN – SAQ SPORTS HALL	SPORTS ACADEMY		
AFTER SCHOOL	PHYSIO EXERCISES	POSSIBLE TRAINING TIME – SAQ PHYSIO EXERCISES	NETBALL 7-10	PHYSIO EXERCISES	PHYSIO EXERCISES	PHYSIO EXERCISES	PHYSIO EXERCISES

Timetable Mesocycle 1, Microcycle 2. Mesocycle 2, Microcycle 3 & 4

WEEK TWO	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
1	LESSONS	LESSONS	LESSONS	LESSONS	LESSONS		
2	FREE DEVELOPMENT PLAN – SAQ SPORTS HALL	LESSONS	FREE	LESSONS	FREE POSSIBLE TRAINING TIME – WEIGHTS	POLY LEAGUE SERNIOR NETBALL MATCH (some weeks)	SOUTH REGIONAL U19 NETBALL MATCH (most weeks)
BREAK							
3		FREE POSSIBLE TRAINING TIME – WEIGHTS	LESSONS	LESSONS	LESSONS		
LUNCH							
4	LESSONS	LESSONS	NETBALL	FREE POSSIBLE TRAINING TIME – WEIGHTS	FREE DEVELOPMENT PLAN – WEIGHTS, GYM		
5	NETBALL	LESSONS	NETBALL	LESSONS P.E PRACTICAL DEVELOPMENT PLAN – SAQ SPORTS HALL	LESSONS		
BREAK							
6	NETBALL	FREE DEVELOPMENT PLAN – WEIGHTS, GYM	NETBALL	LESSONS	SPORTS ACADEMY		
AFTER SCHOOL	PHYSIO EXERCISES	POSSIBLE TRAINING TIME – SAQ PHYSIO EXERCISES	NETBALL 7-10	PHYSIO EXERCISES	PHYSIO EXERCISES	PHYSIO EXERCISES	PHYSIO EXERCISES

Training exercises and Protocols of completing exercises:

SAQ Training:

I will work on a 1:5 work to rest ratio so for every one minute of work I do I will rest for five minutes in order to allow me to recover fully before completing the next set of exercises as for my SAQ training to be successful it requires me to apply the correct technique and complete the exercises at a high intensity.

Drills:

Ladder speed run:

- Two feet in each ladder as quickly as possible
- Concentrating on high knees and quick ground contact
- Enhance timing and stride frequency and quick turnover speed

Single leg run through:

- 8-10 hurdles (approximately 90cm apart) one leg outside hurdles the other going over the hurdles
- Emphasise straight outside leg and quick motion on hurdling leg
- Enhance stride frequency, Strengthening hip flexors, improving lower body coordination

Run through:

- 8-10 hurdles (approximately 90cm apart) run over hurdles, two foot stride between each hurdle with lead leg reaming the same, then at a faster pace with a one foot stride between hurdles
- Emphasise quick knee up, toe up, quick heel to bum recovery
- Enhance stride frequency, Strengthening hip flexors, improving lower body coordination

Hurdle fast legs:

- Stagger 6-10 hurdles (90cm apart), half lining up with left leg, the other half lining up with right leg
- Hurdle pattern: hurdle left leg, hurdle right leg
- Leg sequence: left leg over left hurdle, two steps in-between hurdles, right leg over right hurdle, two steps continued
- Enhance stride frequency, Strengthening hip flexors, improving lower body coordination

Skip for height:

- Skip driving free knee upward, with aggressive arm action

- Purpose to increase hip extension and flexions strength, and ankle muscle stiffness as well as leg power and enhancing stride length

Ladder stride run:

- Agility ladder, one foot down between every other run, at speed
- Enhance timing and stride frequency, quick turnover
- Emphasis upright posture, correct arm and leg mechanics

Side right in:

- Stand to the side of the ladder
- Right foot step into first square, place left foot over square to other side of the ladder
- Right foot into second square, step back with left foot in-front of second square
- Right foot to third square and continue
- Enhances agility, balance, co-ordination, quickness development

Side left in:

- Stand to the side of the ladder
- Left foot step into first square, place right foot over square to other side of the ladder
- Left foot into second square, step back with right foot to in-front of the second square
- Left foot into the third square and continue
- Enhances agility, balance, co-ordination, quickness development

Icky Shuffle:

- Start on left side of ladder
- Right foot into first square, then left foot
- Right foot to right side of the ladder, left foot to the next square in the ladder
- Right foot back to square left foot is currently in, left foot to left side of ladder
- Look up during the drill, avoid looking at feet
- To advance perform backward as well as forward
- Purpose to enhance co-ordination and improve lower-body quickness

Hop scotch:

- Start with both feet in first run of ladder

- Jump with both feet to landing feet either side of the ladder
- Jump and land with one foot inside the next run and repeat sequence alternating foot landing in the run
- Purpose to improve mental processing speed and total body reaction time, enhance total body agility and elastic strength in ankle

In and out shuffle:

- Start two point stance
- Step left foot into first square then follow with right foot
- Step back and diagonally with the left foot until it is in front of second square
- Follow with right foot
- Repeat with right foot leading
- Can add receiving and passing a ball into drill
- Purpose to improve mental processing speed and total body reaction time, enhance total body agility

40 meter lateral shuffle:

- Start in two point stance, facing sideways
- Shuffle 5m to first line, touch line with outside foot and shuffle back to start line, touch with outside foot
- Shuffle 10m to second line, touch with outside foot, shuffle back to start line touch with outside foot
- Shuffle 5m to first line, touch line with outside foot and shuffle back to start line
- Purpose to improve agility, conditioning and strength abductor and adductor flexibility

50m back pedal forward:

- Start two point stance, with back to starting line
- Back pedal 5m to first line, touch with either foot, sprint forward to starting line
- Back pedal 10m to second line, touch with either foot, sprint forward to starting line
- Back pedal 5m to first line, touch with either foot, sprint forward to finish line
- Purpose to improve agility, change of direction and conditioning development

Barrier jump sprint:

- Jump over barrier using extension of hip, knee and ankle
- Land and sprint
- To advance partner gives signal when in air to sprint left or right upon landing
- Purpose to improve lower body power and quickness

Medicine ball wall chest pass:

- Using wall perform chest passes to wall, receiving ball with arms extended
- Advance to shoulder pass
- Improve total transmission of power in the body

Medicine ball over-head throw:

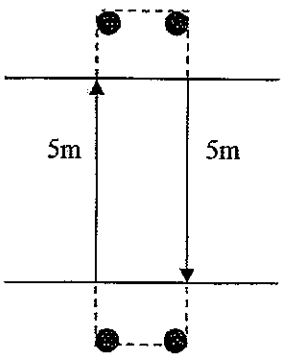
- Lower ball over and behind head then release and receiver ball
- To increase difficulty, stand on one leg and complete exercise
- Purpose to improve explosive power in throwing or overhead activities

Medicine ball side toss throw:

- Face the wall with medicine ball at side
- Throw ball striking wall in front
- Purpose to enhance explosive rotational mechanics and changes in direction

Speed / Interval training:

- Sprint 10metres, walk 5m back to start (recovery), repeat 3 sets of 8 reps



Key:

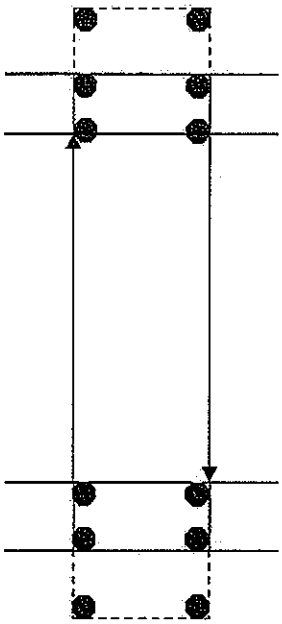
= 100% sprint

---= Walk

— = Start / Finish line

● = Cone

- Sprint 20m, Jog 5m, Walk 5m (recover), repeat three sets of 6 reps
- Sprint 30m, Jog 5m, Walk 10m (recover), repeat three sets of 6 reps



Key:

↑ = 100% sprint

---= Walk

— = Start / Finish line

= Jog

● = Cone

Weight / resistance training:

I will complete the exercises outlined below; I will exhale at the start of major exertions and inhale at the eccentric phase, with a fast concentric contraction improving power and a slow eccentric contraction providing good overall strength gains. When I am completing the lifts I will ensure my spine is in neutral, I have tight abdominals and gluteus muscles and I achieve a full range of movement.

For all lifts I will complete at 80-85% of my one rep max. With 3 sets of 5 reps in order to improve my overall body strength and power and as a result improve my power and acceleration. This is the correct sets, reps and percentage of one rep max to specifically target and improve power. I will have rest periods of around one minute between exercises. During my training I should experience strength gains and therefore my one rep max should increase. I will need to use the training principle of progression by increasing the weight of my lifts of each mesocycle, if my results suggest that there has been an improvement in muscular strength.

Protocols of all lifts will include:

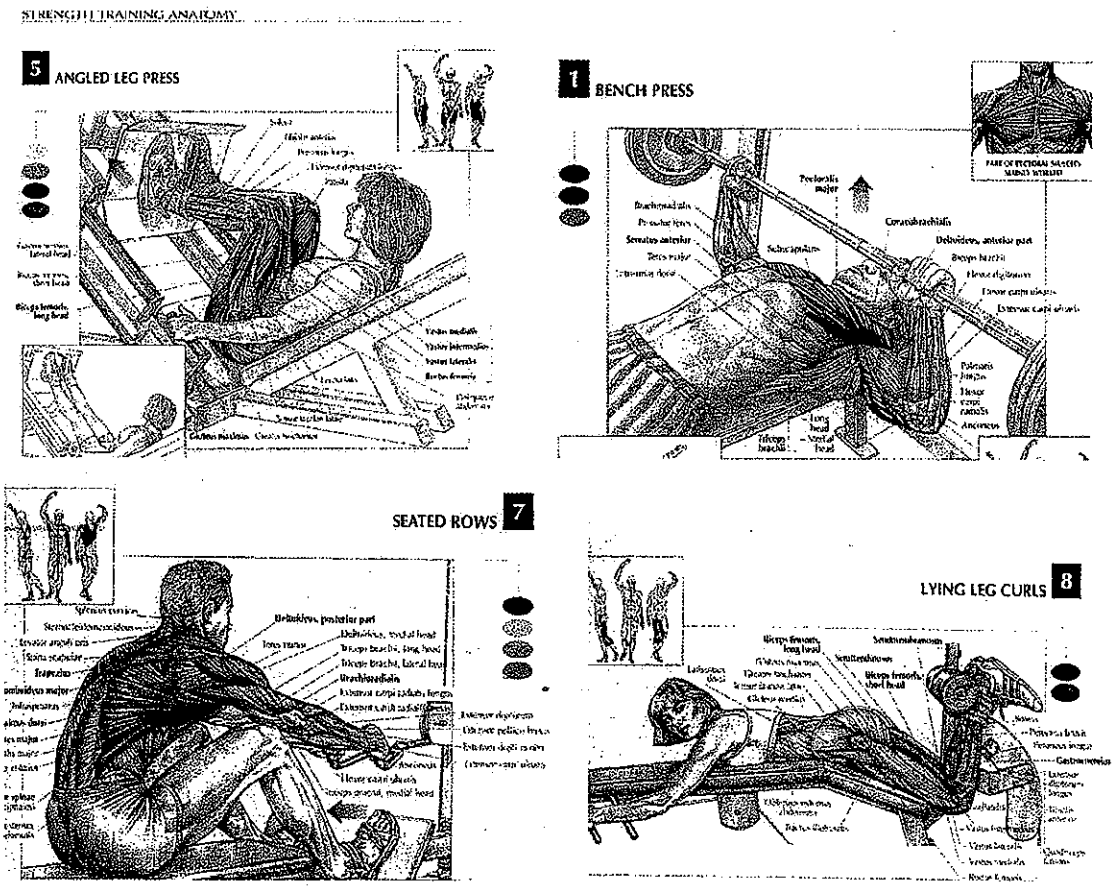
- Inhale during eccentric contraction
- Exhale during concentric contraction (major exertion)

- Core should be contracted: spine in neutral, right abdominals and gluteus muscles
- Complete the full range of movement with each exercise
- Ensure others are always around to help, though I am mainly using machine weights so safety shouldn't be a problem, to be safe I should always complete sessions with others

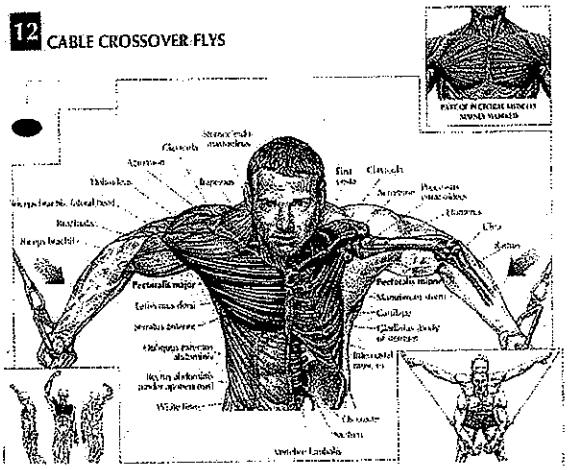
The order in which I complete my exercises will be multi-joint compound exercises (core) such as the bench press, seated row, and Lats pull down before single joint exercises e.g. bicep curls, where single muscle groups are isolated and worked.

If successful my weight / resistance training programme will result in the long term adaptation of muscular hypertrophy.

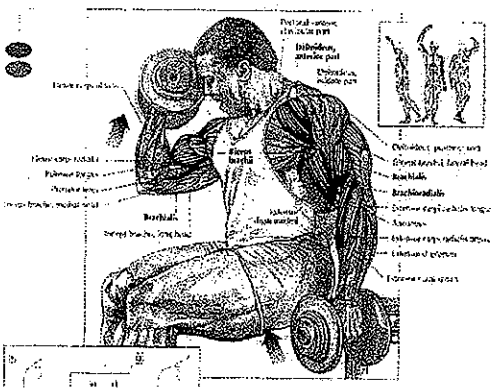
Below are diagrams that show the main muscle groups worked in each lift:



12 CABLE CROSSOVER FLYS



1 CURLS



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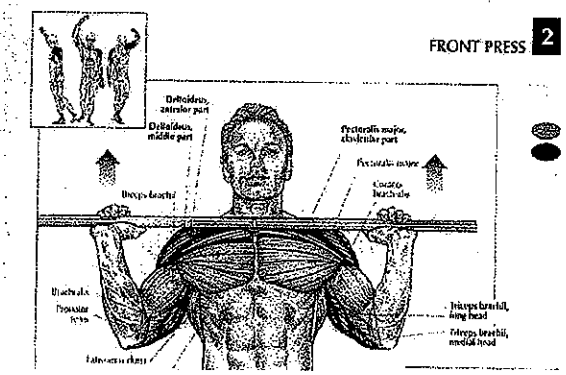
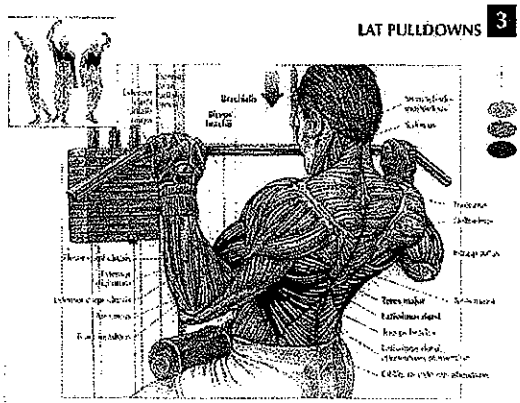
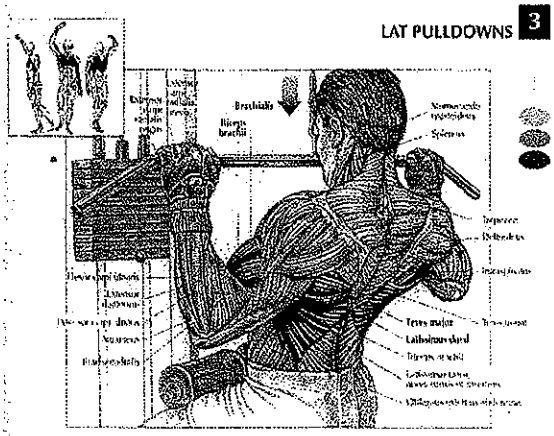


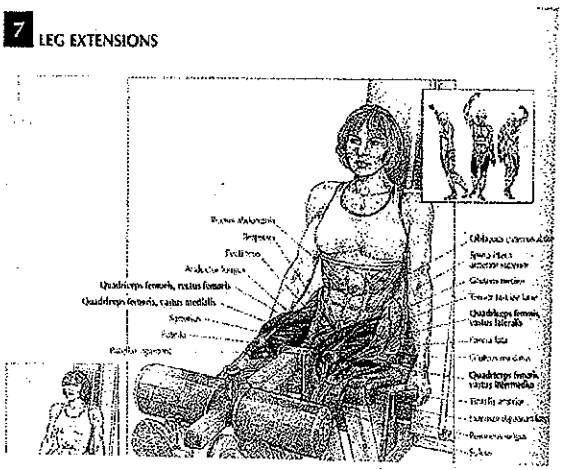
LAT PULLDOWNS 3

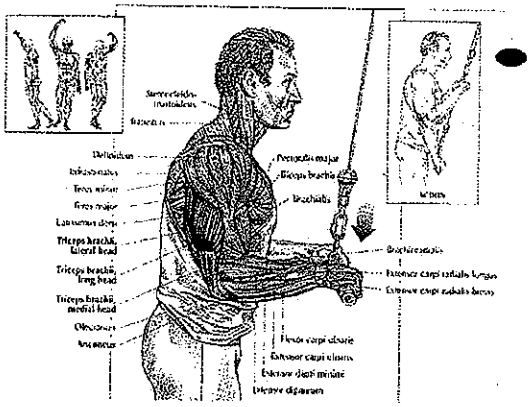


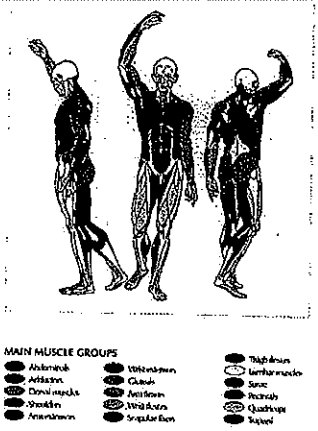
LAT PULLDOWNS 3



7 LEG EXTENSIONS







Exercises - Foundation programme:

Lift	Mesocycle 1: 80-85% of 1 rep max:	Mesocycle 2: 80-85% of 1 rep max:
Leg Press:	8 plates	11 plates
Bench Press:	4 plates	4 plates
Seated Row:	11 plates	13 plates
Hamstring Curl:	1.5 plates	1.5 plates
Cable Cross Flys:	2.5 plates	2.5 plates
Bicep Curl:	Left: 8 kg Right: 10kg	Left: 10 Right: 10
Shoulder Press:	Left: 8 kg Right: 10kg	Left: 10 Right: 10
Lats Pull Down:	4 plates	5 plates
Leg Extension:	4 plates	4 plates
Tricep Pull down with rope:	4 plates	5 plates

TRAINING SESSION & DIET RECORDS: MESOCYCLE 1, MICROCYCLE 1