# Personal Exercise Programme

## Aim

To increase my core and upper body strength, in conjunction to the expected muscle hypertrophy of the major muscle groups I would expect my BIA reading to drop. I play in the scrum in rugby therefore it is essential to have a strong neck and back, combined with overall core strength.

## Background

Before last season I hadn't played rugby for around two seasons. The 'modern game of rugby is very physical with ferocious tackles and hard impacts' (Reid, 2004), and through increased muscle bulk, this should hopefully benefit me, not only in breaking the game line, and rucks and mauls but also, most importantly reduce the risk of injury.

Rugby is a sporadic game made up of generally short phases, each requiring maximal exertions (Reid, 2004). My PEP shall aim to improve my maximal exertions; I shall test this through the one rep max and a grip dynamometer tests.

## Previous training

At the age of seventeen I started going to the gym, this was sporadic and didn't really serve a direct purpose and involved both cardiovascular and strength exercises. I didn't have a specific aim neither did I work specific muscle groups; this used to occur where possible twice a week. During the rugby and hockey off-season I would go for at least a forty-minute run once a week and play cricket for at least one day a week (40 over bat and bowl). During the rugby/hockey season I play matches on Wednesday's and Saturday's I also trained once or twice during the week. Around this I also tried to fit in at least a couple of gym sessions as mentioned and work all Sundays – which sometimes involved lifting heavy objects.

## Strength training definitions and principles:

'The ability to exert a force against a resistance' (www.brianmac.demon.co.uk, 2003)

'Maximum force that can be developed in a muscle or group of muscles during a single maximal contraction' (Wesson and Wiggins, 1998)

www.brianmac.demon.co.uk, 2003 suggests there are three classifications of strength; maximum, elastic and endurance. My personal exercise programme focuses on maximum strength training; because of this I shall discuss this in more detail.

Sharkey, 2003 suggests that three training sessions per week per muscle group is the minimum frequency that which causes 'maximum gains in strength'. Sharkey, 2003 in

his reviewed notes suggests that the key to muscle hypertrophy is to place the muscle under at least two thirds it maximum strength.

Intrinsic of the muscle, two classifications of adaptations occurs; myogenic and neurogenic. Sharkey highlights the following adaptations that occur within the muscle:

- number of myofibrils
- sarcoplasmic volume
- protein
- supporting connective tissue (ligaments and tendons)

Galligan et al conveys these views on strength training and muscular strength:

- A rugby player should specifically try and improve their sustained strength; 'maintain maximal forces over repeated contractions'.
- Suggestion that muscle hypertrophy may be a hindrance, but that speed of strength must also be developed.
- Increased length of muscle increases stretch increases force generated.

Wesson and Wiggins suggests that cross-sectional area of muscle tissue and muscle fibre type is directly related to the muscle within. Therefore I know if I direct my training programme at specifically type two a muscle fibres and notice and increase in size than in theory I should be stronger and my training programme has been a success.

Micro Target

Weekly blocks where improvement is not necessarily significantly noticed but motivation is maintained by constantly altering stresses placed upon the performer. To feel competent accommodating a weight at 80% my one rep, for 6 reps, with a progressive, critical view placed upon performance to monitor improvement.

Meso Targets

One or two month blocks, where realistic aims of muscle hypertrophy are first clearly realised. Improve my one-repetition max by 10-20%, - muscle bulk increased and my BIA reading to have lowered.

Macro Target

Follows a one or two year training period. Significant muscle hypertrophy, muscle levels at an accepted level, main concern is maintaining levels reached and keeping up cardiovascular work, keep BIA reading below 28%.

Planning and research

Strength training 'involves high resistance and low repititions…leads to following adaptations:

- Increased contractile protein (actin and myosin)

- Tougher connective tissue
- Reduced inhibitions
- Contractile efficiency
- Number of muscle fibres.'

(Sharkey, 2002)

According to Sharkey, strength training research has strongly suggested that both types of muscle fibres improve with strength training , but that growth of the Fast Twitch Two A has a more pronounced growth. An interesting flip side is that research also suggests though that it doesn't influence the production of the other one and vice versa.

Van Linge (1962) transplanted the tendon of a small rat into a position where it would have to assume a tremendous workload. After a period of heavy training, he studied the rat muscle and found that the transplanted muscle had doubled its weight and tripled its strength. …stimulated new muscle fibres…suggestion for satellite cells in muscle hypertrophy…theses helped in the production of new fibres (Barton-Davis, Shoturma, and Sweeney, 1999) extracts from Sharkey, B J, 2002

The benefits of resistance training are varied and great: 'Resistance training offers greater development of muscular strength… mass… maintenance of Basal Metabolic Rate… bone mineral density… glucose tolerance, and insulin sensitivity' (http://circ.ahajournals.org/cgi/content/full/101/7/828, 2000)

The two principles I intend to base my programme on are S.P.O.R.T. and F.I.T.T.

**Specificity** – Not only must the training undertaken be sport-specific but must also undertake the relevant component of the exercises that you wish to improve. I shall aim to improve my one-repetition maximum by using static weights in the gym for my upper body e.g. *pectoralis major,* Biceps brachii, Brachialis, Brachioradialis, Pronator teres, trapezius, triceps and the abdominal muscle group to name but a few. I shall also use free weights in my own home to compliment the gym work where I am unable to complete gym sessions.

**Progressively Overload** – Training must be monitored and moved on to prevent plateauing or staleness (see FITT principle). Every two weeks I shall review my progress and increase the weights and alter the reps accordingly; I aim to push myself hardest on Fridays as I then have a two day rest period before my next session.

**Reversibility** – After periods of detraining adaptations that occurred would be lost; muscle atrophy, Sharkey, 2003 suggests if one training session was undertaken per week strength will be maintained for up to six weeks. I must maintain my work load and not allow it to drop – although with weight training it would take many weeks period before I became to experience muscle atrophy.

**Tedium** – if sessions become boring and monotonous performer may not have much motivation to succeed and continue with sessions. I shall keep to the same routine but through changing intensity or having someone else training with me (psychological effect of social facilitation) shall hopefully keep me motivated.

I shall now apply the principle of FITT to help me with the overload principle:

**Frequency** – I shall undertake my strength training programme three times per week; Monday – medium/heavy session, Wednesday – medium session, Friday – heavy session. Between these sessions I aim to do some cardiovascular work and recreational sport.
**Intensity** – Each session I shall aim to complete three sets of 6-10 reps each cycle of the machines which I shall aim to complete three times during the whole session.
**Type** – each session shall involve small batches of 1 – 6 reps being optimal for neuromuscular and maximum strength to help facilitate muscle hypertrophy. (Fleck & Kraemer, 1996)
**Time** - A whole session shall last 1 – 2 hours, with five minutes rest between sets, which is the maximum required for ATP to return to 50% of their pre-exercise levels.

Tests and protocols:

Wesson and Wiggins suggest that strength is best measured using dynamometers, these give an objective measure of the forces generated for the specific muscle group targeted. The easiest test to undertake is the hand grip dynamometer, which is achieved by the following technique:
Hold in hand with straight-arm at 90 degrees to your body, begin squeeze and bring arm down towards body, breathing out during process. Record maximum readings from three attempts for left and right hands.
See appendix A for suggested grip normals.

I shall undertake my strength training programme primarily in my local gym (HRSFC). This does in part limit me to using variable resistance machines (VRM), there is much debate as to the benefits and draw backs of machines but unfortunately in the restricted environment upon which I am faced I shall have to make do with what's available. At home I have some free weights; 25kg dumb bells, for consistency I shall try and just use the VRM at the gym but if the need arises for me to complete my programme via free weights when the gym isn't available then I shall have to adapt to the given situation.

Reverse biceps curl: Sit upright, grasp weight with palms facing towards the front of your body. Contract your abdominal muscles, thus stabilizing trunk and spine. Keep your upper arms perpendicular to the floor. Slowly raise the weight by means of flexion at the elbows, keeping upper arms stationary. Raise the weight to the limit of your natural motion, comfortable. Slowly return to the starting position.
N.b. Do not arch your back. Keep your body still and straight. Control the weight throughout movement.

Pec Dec/ flies: Sit upright, with back flat against rest and bum firmly positioned in the seat. Place forearms against pads, ensuring right angle is formed with upper arm; this is best produced by lowering the seat. Keep your palms facing forwards, produce circumflexion of your chest with both arms keeping constant tension throughout movement. Slowly in a controlled manner move arms, together ensuring hands don't touch.

Vertical Bench-Press:
Adjust the seat height so the bar is gripped at low- to mid-chest level. Keep firmly seated and that back is firmly against the vertical back pad. During movement keep elbows perpendicular to the line of your body, contract abdominal muscles, and maintain posture as whilst remaining as still as possible. Push bar forward, almost to complete lockout. As the weight is lowered elevate and push out your chest slightly.

Shoulder press: Once comfortable, push back, bum and legs into seat and support, when pushing with weight make sure even force is exerted from both arms, hold momentarily at each point and return to start.
Sit upright with the back of the bench against your back, and your feet comfortably on the floor.

Hold the weights slightly more than shoulder width apart, and lift above the head, with straight arms. Lower the weight either to the front or rear, if using a barbell. Avoid arching of the back, and hitting the neck if taking to the weight to the rear.

**Technique for lifting**

According to http://familydoctor.org/handouts/198.html, 1999 you shouldn't 'hold your breath when you lift heavy weights. You may faint and lose control of the weights. Breathe out when you lift… Don't exercise any set of muscles more than 3 times a week', these are very important and I must consider when lifting to not cause injury. www.efit.com, 2003 reiterates the point of breathing when using weights as an important safety issue, it states that it can help you 'avoid raising your blood pressure to a dangerous level, and keep you from developing headaches, dizziness or even fainting'. www.Efit.com, 2003 also suggests that if correct breathing technique is implemented that you might even be able to lift heavier weights than previously, exhale on weight, inhale on easy part of the repetition.

Pros and cons of variable resistance machines (VRM):

www.brianmac.demon.co.uk suggests that VRM are particularly effective at working muscle groups in isolation, whereas free weights allow you to target surrounding muscle groups along with the particular one to assist the movement. It does appear that there are more positive comments about using free weights but a solid foundation from which to base your programme needs to be established before maximum benefits can be achieved via a free weights training programme. Once the surrounding muscles have been

conditioned the weight lifted can be increased accordingly, these muscles also help to stabilise your body, support limbs and maintain posture. There is also suggestion that neuromuscular pathways and connecting tissues benefits from all forms of weight training. A study by Stone et al was undertaken investigating benefits of free weights against resistance machines, the free weights group was deemed to show significantly better improvements then the other, this was attributed to many factors. The most important factor that I believe I must consider for my programme was that it was deemed that free weights mimic sporting movements more effectively and this is the application to which I am completing my programme for. Unfortunately I do not have large quantities of free weights available to me; therefore I shall just have to complete the programme to the best of my ability and facilities around me. I shall have to consider this factor when discussing the effectiveness of my fitness programme and its application in a sporting environment.

Warm ups, cool downs and stretches:

Warm ups have both psychological and somatic benefits.

- Psychologically benefits: it shall help you mentally prepare for the activity ahead; visualise success, fulfil goals etc.
- Somatic benefits: Release of adrenaline, shall increase heart rate which in turn dilates capillaries; increasing the potential speed that oxygen can be delivered to the working muscles. Increased body temperature leads too… muscles being more pliable and decreased viscosity within muscles. Enabling greater extensibility and elasticity of muscle fibres which in turn facilitates greater contractions creating more power in your muscles. Basal metabolic rate increase leads to an increase of 10% in enzyme activity…through warm-up increases catalysts ability to work; facilitates enzyme activity and increases muscle metabolism therefore, ensuring glycogen is broken down quicker and is more readily available. Synovial fluid production increased, reducing the chance of injury.
- Cool downs can take two forms active or passive, an active recovery may involve participating in an activity which tapers in intensity as duration continues, safely reducing the effort applied, thus lowering heart and breathing rate. The reduction in intensity of respiratory and cardiovascular rates acts to delay (the) onset (of) muscle soreness (DOMS). This is especially important for me as I am going to be undertaking high intensity exercises that may involve eccentric actions, if cool downs are not performed DOMS can occur for up to 48 hours after the training, which would be detrimental as it would throw all my other sessions out of sink. Galligan et al suggests that DOMS is largely due to micro fibre damage (specifically to the z-lines and sarcolemma), leading to a leakage of Ca+ which in turn activates enzymes, which then break down muscle proteins and causes an inflammatory response…of pain.

See appendix B for a selective list of possible upper body warm-ups used.

Excess Post Exercise Oxygen Consumption (EPOC)

Beashel and Taylor, 1996 state the opinion that during recovery from a strenuous activity the uptake of oxygen remains above the equivalent rate needed for the recovery period. Clegg suggests that EPOC can be divided into two components; fast and slow. My PEP is based upon strength training which generally stresses the ATP and PC system; therefore I shall focus upon this system which affects this – fast. The fast component, otherwise known as alactic debt or alactic recovery oxygen consumption refers to when oxygen is required to 'regenerate the phosphagen system of ATP and PC, and to resaturate the myoglobin and tissue fluids with oxygen.' (Clegg, 1995) Alactic oxygen debt suggests that I could recover fully (in terms of ATP and PC stores) to a pre-exercise state in five minutes and therefore continue training for another set, repetitively. This is due to levels falling very rapidly in the first few minutes but consequently replenishing at an ever reduced rate. 'In the first 30 seconds after exercise 50% of ATP and PC stores are replenished, stores completely replenished after five minutes' (class notes).

The points raised just emphasise the fact that recovery from hard work is essential via cool downs and recovery exercises. Sub maximal exercise is performed immediately after the exercise to prevent muscle soreness (DOMS), stiffness and facilitating recovery.

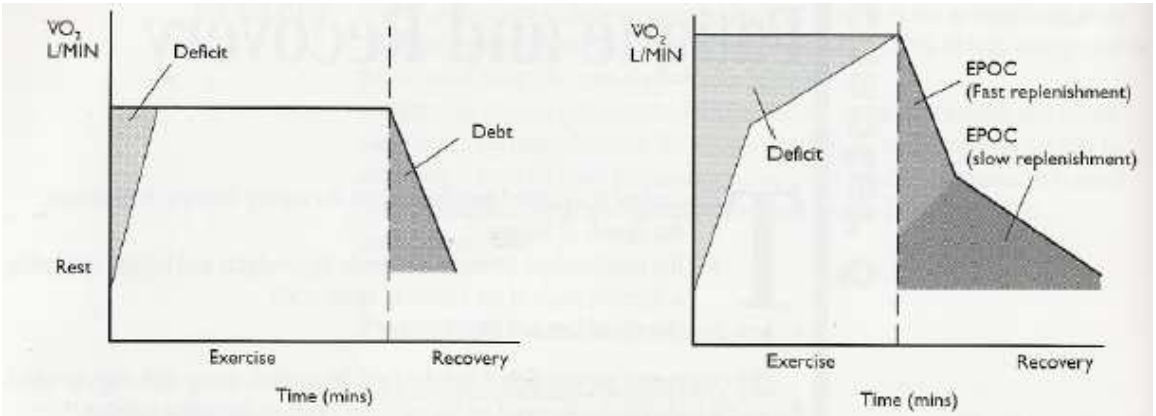



Fig. 6.1 Oxygen deficit and debt during low intensity (sub-maximal) exercise

Fig. 6.2 Oxygen deficit and debt during high intensity (maximal) exercise

[1]

Training systems: (referenced www.netfit.co.uk)

Can take two forms; simple sets and pyramids.
Simple sets: good for beginners, easy to comprehend the high number of repetitions allows performer to graduate programme and to acclimatise slowly. Example. 3 x 8/12 with 70% - this implies completing 8 to 12 repetitions at approximately 70% of 1RM.
Pyramids: more complicated, solid foundation and previous lifting background required to undertake this programme. This is high intensity and shocks the muscles to help overcome possible plateaus in performance – continue with desired weight until

[1] Wesson and Wiggins, 1998

positive failure occurs and reduce weight accordingly each set. Example. 60 x 10, 70 x 4, 75 x 3, 80x 2, 85 x 1.

You can repetition in different forms: partials, Negatives, Stripping, Burns, Super Sets, Tri Sets, 21's.

21's – half movement for 7 reps, do other half for a further 7 reps, do 7 full reps. Example. Bicep curl; 7 reps arms straight to 90 degrees, curl from 90 degrees to arms perpendicular to floor, 7 full reps.

University of Alberta and the University of Victoria in Canada in the late 1980s conducted a study for strength training with the application to rowing. And it deduced that lifting should have an emphasis on 'specific movements', such as the biomechanical movement of the sport. I must consider this when undertaking my programme so as to not make the exercises to restricted, thus suffering by not having an appropriate application for the exercises.

For my warm up I shall use 21's as a simple motion combined with stretching and pulse raiser etc. for my actual session I shall follow the simple sets procedure.

In most human activities 'eccentric motion precedes a movement in the intended direction' (www.pponline.co.uk, 2004) later on the article continues by saying '…performance is enhanced by the prior countermovement'. Therefore I shall aim to encorporate this knowledge into my PEP. The Journal of Strength and Conditioning Research has conducted research into the application of overloading or eccessove stressing of the eccentric part of the lift movement. They found that by specifically targetting this portion has added benefits beyond that of an equivalent concentric contraction.

Swimming:

When I feel sufficiently fatigued, stressed or require some light rehabilitation from an injury etc I shall aim to go swimming. tms.ecol.net, 2000 suggests many benefits varying from stimulating circulation to helping build my body. tms.ecol.net. 2000 writes that people wishing to complement a routine often find swimming as a morale and physical boost to training programmes,

ATP-PC system:

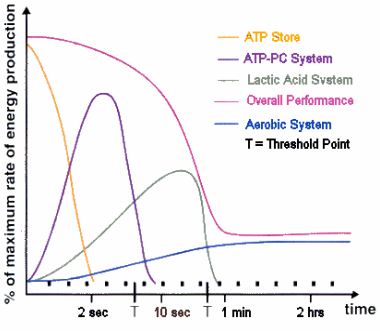
Galligan et al, 2000 links fatigue with ATP – 'immediate demand for energy…8 – 10 seconds comes from phosphocreatine breakdown. …depletion of PC reduces intensity of ATP resynthesis and thus the muscle reduces power output'.

| Duration | Classification | Energy Supplied By |
|---|---|---|
| 1 – 4 seconds | Anaerobic | ATP (in muscles) |
| 4-20 | Anaerobic | ATP + PC |

| | | |
|---|---|---|
| 20 – 45 | Anaerobic | ATP + PC + Muscle glycogen |
| 45 – 120 | Anaerobic, Lactic | Lactic Muscle glycogen |
| 120 – 240 | Aerobic and Anaerobic | Muscle glycogen + lactic acid |
| 240 – 600 | Aerobic | Muscle glycogen + fatty acids[2] |

I shall predominantly stress my ATP PC systems and muscle glycogen; I can establish this as I know I will not complete repetitions for more than 45 seconds in one bout.

To further illustrate the systems and when they occur note the graph below:




Here you can clearly see how the energy systems contribute to the manufacture of ATP over time, when working at 100% effort. The thresholds are indicated at the point where the specific energy systems and completely depleted.

ATP – PC (phosphocreatine system) is a high energy source found in a muscles sarcoplasm the bond splitting of the P and C is caused by the break down of the ATP. This liberates copious amounts of energy; this process is aided by the enzyme creatine kinase. This system is important, especially when testing my one repetition maximum as this shall be my dominant energy system. When completing my repetitions muscle glycogen may play a partial role towards the end of a particularly heavy set.

<u>Fatigue:</u>

'The decrease in muscle performance in repeated contractions' and 'inability to maintain power output during repeated contractions' (Galligan 2000)
'An imbalance between ATP requirements and ATP resynthesis' (Barry 2001)

Fatigue can take one of two forms: central and peripheral

Central fatigue – where psychological factors affect the brain and nervous system. A drop in glycogen levels sensed by the brain enforces a reduction in power output in an attempt to conserve energy, but if a stimulant such as a close finish line combined with social facilitation may overcome this feeling and cause a surge of energy, one last push for the line.

[2] energy pathways, www.brianmac.demon.co.uk

Peripheral fatigue – muscles and neuromuscular junctions are affected due to – a depletion of energy and the inability of muscles to have the ability to contract, due to metabolites.

Glycogen stores are depleted through exercise, and can significantly affect performance by increasing time period to complete activity. This has an adverse affect psychologically as the performer may not feel capable or willing to continue with further reps or sets.

Lactic acid can have an adverse affect on performance; it can also benefit the body. During recovery it can be broken down into pyruvic acid – an energy substrate, this is beneficial to the heart and other muscle tissues. Build up of lactic acid is caused through anaerobic activity such as weight lifting, and can cause enzymes to not work efficiently, by lowering the pH in the blood.

Fluid loss can be supplemented by the intake of sports drinks – isotonic, hypotonic and hypertonic. These sources of hydration also act to aid glucose concentration, whilst giving a boost of carbohydrate, and top up muscle glycogen stores.

Sweating can lead to dehydration, which links into fluid loss, along with loss of vital salts and minerals which need replenishing. It is essential to remain hydrated, it is suggested you drink four litres of water a day (Runners World, 2003).

The body can attempt to resist the affect of fatigue by buffering the onset of lactic acid. These can be achieved for 10 – 15 seconds; this is idiosyncratic in nature but can also be altered via training.

Lactic Acid

Anaerobic glycolysis is a method whereby energy is released to resynthesise ATP without the presence of oxygen. A series of reactions must occur for this to happen, resulting from ten chemical reactions, this involves the break down of carbohydrates 'in the form of glucose…glycogen to pyruvic acid' (Galligan et al, 2002) if not enough oxygen is present than nicotinamide adenine dinucleotide (NAD+) cannot loose the H+ (hydrogen). To prevent rising levels of acidity pyruvic acid accepts the H+ and forms lactic acid. Due to the raised levels of H+ 'is thought to interfere with the binding of Ca+ to the troponin-tropomyosin complex…muscle contraction affected' (Galligan et al, 2000) the lowered pH in the blood, associated with the H+ and Ca+ leads to a sensation of pain, enzyme activity is therefore inhibited due to an amalgamation of factors. If the muscle contraction if affected it can have an adverse effect on my training sessions as I will be unable to lift weights of an acceptable weight, for a shorter duration of time. Lactic acid is not a waste product. During prolonged bouts of intense exercise 'the heart …other muscle tissue' (Galligan et al, 2000) can derive almost 50% of energy from lactic acid. This is due to lactic acid having the ability to be oxidised after and even sometimes during exercise, but it is generally accepted that lactic acid is removed within one hour and 50% within 15 minutes. Lactic acid can only be removed this quickly if an active

recovery occurs, where you breathe at a heavier rate then what you require at the moment to help replenish the oxygen deficit, otherwise it could take up to twice as long to remove the lactic acid.

Dietary and nutritional considerations:

Galligan suggests that the reference nutrient intake (NDI) for protein lies at approximately 0.8g/Kg/day. For persons wishing to undertake strength training it may be necessary to increase consumption to 1.7g/Kg/day. To compensate for this I shall take a protein supplement shake instead of breakfast every morning. This contains 14g of protein, here I am allowing the bodies ability of extracting protein from my diet, maximises getting the most from my training sessions. Galligan also suggests that the general consensus is that a typical western diet contains high levels of protein anyway and that if the levels of protein in the diet are too high that it could lead to kidney problems, as they are put under greater pressure to excrete the excess. I am not too concerned with my calorie intake every day as I see myself as moderately fit, healthy and athletic. During the period which I intend to undertake my PEP I shall predominantly be eating salads and light brunches. This shouldn't cause any problems when it comes to calorie content, also during these months I will undertake a lot of aerobic activities.

Weight = 12 stone, 1 pound
0.8*75 = 60
1.12*75 = 87.5
Levels sourced from (sportsmedicine.about.com, 2004)

Therefore I should aim to consume approximately 87.5 grams of protein per day, when I am actually training. This figure of 1.7g/Kg I believe is aimed towards serious bodybuilders, therefore I should bare in mind this as I am not training as intense or as hard as these people may. 'The amino acids arginine and ornithine promote release of growth hormone… influences muscle development' (sportsmedicine.about.com, 2004) this suggests that through consuming larger amounts of protein you are increasing the probability of stimulating muscle development. There are risks that if too much protein is consumed it shall just be merely excreted this leads to the loss of calcium and dehydration, just in case I incur such problems I shall ensure that I consume excess calcium (predominantly from milk and cheese) and maintain hydrated at all times.

A healthy scoop of the vitamin and protein supplement contains approximately 15g of protein. Therefore I must supplement this intake with a diet rich in protein. Muscle and Fitness, 2003 has some suggestions for meals that have high levels of protein, without having excess fat or salt levels. A suggested meal is 'hot body chilli'; this meal contains 228 calories, 22g carbohydrates, 2g fat, 6g fibre and 30g of protein. Muscle and Fitness, 2003 continues to suggest consuming more meals more often of smaller amounts throughout the day, therefore if I had a vitamin and protein supplement for breakfast (15g), salad and chicken breast (≈23g) for snack, chilli (33g) for lunch and lasagne roll (20g) ups this would set me up well towards my aim of 130g of protein on training days. See appendix D for other suggested meals.

Week by week review of PEP

Trial week:

I trialled various training methods, recorded food, water intake and exercise. Overall this week has given me a lot to consider:

- The forward planning aspect of my PEP; I must be careful if I wish to keep to the schedule laid out in my PEP. I found through playing American football just before the gym on Wednesday it affected my motivation to continue with the session, I was hot, fatigued and peer pressure led me to not wishing to continue – I MUST NOT let this happen again.
- When it was very hot I didn't wish to complete a full session, this is due to lacking motivation – I MUST fight through this to complete and to fully maximise the potential gains, through the use of a full session.
- Which methods of strength training best suit what affects I wish to achieve, i.e. one rep max, or muscular endurance. I wish to improve my one rep max – therefore I MUST maintain high weights, small reps and sets. From this one week I cannot ascertain any certain benefits, I shall just have to base my PEP solely on the research collaborated previously.
- I believe I'll find it more beneficial to record everything together, but chronologically to help me recognise dietary needs and water intake. This should help with working out muscle/fat gains over the training period.
- According to http://www.netfit.co.uk/wkstr.htmyou you should allow '48 hours (to) elapse between sessions, avoid training sore muscles…because… training strenuously, you will find it extremely difficult to maintain the same level of lifting at each session'. I have noticed this 'soreness' that it talks about, therefore I must ensure that I leave sufficient gaps between strenuous activities.

Week 1:

Throughout this week I have felt a noticeable increase in performance especially so on the 'pec dec machine'. I felt that I could quite comfortably cope with the weights I experienced; therefore I altered the weight I used but maintained a 10 rep set. I aim to review my one rep maximums on all the machines to set new target zones to work in. The arm curl machine was out of order this week, therefore I used free weights at home, instead – the problem I found with free weights was that they didn't sufficiently isolate the muscle group which I wanted to work on. Therefore I used weights below my max so as to maintain correct posture and action. This week hockey training started, with an emphasis on increasing cardiovascular fitness levels. I am already running once a week but shall now increase this to fall in line with expectations set at the hockey club. I shall try to incorporate the runs around my gym sessions (Tuesday and Thursday are the two days specified by the hockey club), I shall give this a few week's trial and see whether or not my performance in the gym decreases as I increase my work load and weekly exercise.
*I have decided not to record all food and drink intake. It became tedious and time consuming, also trying to work at calories wasn't feasible. I believed it to not be

sufficiently beneficial for me to record everything down, I just must be aware of my diet. Taking a protein shake, once daily which contains most essential vitamins and minerals, I believe my diet should be sufficient to support my training programme.

Week 2:

On Monday I reviewed my one rep maximums. I found that only my results on the pec dec have increased sufficiently to allow me to lift the next weight on the scale. I found that with regards to the other machines; the weights appeared easier to lift but I still couldn't lift the next weight in the continuum, in a comfortable controlled manner. By considering all of these points I have decided this fortnight, till my next review, to do sets of 5/6 repetitions for maximal strength gain. I believe this to be acceptable as I have now achieved a 'perfect technique' for lifting and breathing… therefore I shouldn't have a risk of injury, maximising gains with minimum risk of injury. As I continue through this fortnight I shall attempt to adapt the weights/set/reps according to my ability and welfare.

Of all my reviews the arm curl was most disappointing. The weights I could lift did not appear any easier than my last review, I believe that through the machine being out of order I have not committed enough time, effort and resources to focus on the bicep, triceps muscle group. For future awareness I must ensure that I do not forget to work a muscle group sufficiently even if machines are not working.

Week 3:

During Tuesday my arms and neck/shoulder region felt fatigued from the hard session on Monday, through this I made the decision not go to hockey training on Tuesday. Instead I went for a swim. This was relaxing and eased my muscle groups; afterwards I felt I had benefited from this relaxing cardio workout. Now I am training at a higher intensity I need to be aware of the repercussions of my actions and what sports/activities I have after my gym sessions for the next couple of days (this point was raised during my trial week). I believe that through working from next week onwards it would make sense to complete my hardest session on a Friday where I have the maximum amount of time for recovery without it affecting my work or other gym sessions. On Saturday I played cricket, through completing a hard session on Friday I believe it to be at the detriment to my performance. I bowled a few overs and got a couple of wickets – but I wasn't pleased with my performance, through throwing a ball in from the boundary I hurt muscles on my back, on the right hand side – but soreness had worn of by Sunday.

Week 4:

I started work this week; this involved passively participating in junior sporting activities on a kid's camp. The week was exhausting – never getting a moment to relax, at the gym on Monday I was too tired to complete a full, scheduled session. Tuesday I got home late therefore I couldn't make it to hockey, or cricket training. Wednesday I was supposed to play cricket but it was rained of, I didn't have my gym kit so just came home and relaxed.

Due to all this relaxation time I have not stressed my body physically, either cardio or weights. Thursday was uneventful, on Friday I got up early and went for a run as I hadn't been all week – afterwards I felt it was worthwhile but before/during I lacked motivation to start it! At work I played 1½ hours of basketball and then swam for an hour. After work I went to the gym, but was so physically drained and achy I physically could hardly lift the weights, I came home and had 12 hours sleep! On Saturday I played cricket, I bowled – 5 overs, felts ok. No problems. Worked on Sunday, normal, easy day. Here again I didn't heed previous warning of not over doing myself, this was most evident on Friday; I must ensure that my sporting activities are equally spread throughout the week.

Week 5:

This week I was determined not to miss anymore gym sessions, so to maximise the effectiveness of them I have decided to go before work. This involves me getting up at around 6.15 to be in the gym for seven! I have coped ok in the gym but have felt that I am under pressure to cut my gym session short – this means that my sets are almost becoming 'Super Sets' involving me moving from one station to the next in quick succession without sufficient time to recover. This may also mean I stress a slightly different energy system and acquire different attribute changes. I am very tired in the mornings due to my large work load, so the motivation to consistently go running once a week and to maintain my gym sessions has been hard to follow through. All gym work has been completed this week and my one rep max' have gone up; this is evidence of improvements (see graphs). It has come to my attention that when completing my reps I need to consider that often if I am continuing for many repetitions and that a loss of technique occurs. Here I may not just be using the expected muscle group for the movement; this is evident with the shoulder press, arm curl and in part on the pec dec. I found that especially on the arm curl I was rolling my shoulders and slouching. For these machines I shall need to lower the weight so that correct posture and technique remain.

Week 6:

This week's gym session on Monday was ok, suffered slightly from a cold. On Tuesday I had a full cold and cough, felt achy, had headaches and my sinuses felt inflamed and 'flu like'. Decided against gym session on Wednesday to help recuperate from cold as I was still suffering …continued into the weekend. I decided to go to the gym on Thursday as an intermediate session between Wednesday and Friday. This was also in part due to the knowledge I had a cricket game on Saturday and didn't want to be sore for that. It was unfortunate that I had to miss a gym session this week, as I'd promised myself last week I wouldn't, but I believed that in the long run for this method to be more beneficial. The fact I succumbed to a cold this week may be in part due to the fact I may have been over doing it lately. I have been working six days a week, playing cricket all day, on my days off, and staying out late repetitively. I shall try not to slip into a similar predicament again; else I feel that I may again suffer from some illness. Didn't go for a run this week as I was still suffering from the aforementioned cold.

Week 7:

The realisation of the looming hockey season means I feel that I must 'step-up', my cardiovascular fitness training. I Went to hockey training on Tuesday – much CV work undertaken. 40 min run on Thursday. Again on Saturday I went for another run, this lasted 45 minutes. This session followed a similar system to Wednesdays, I ran and my sister followed on her horse – today was quite hot and we had to stop two or three times for the horse – momentarily for 60 seconds approx, in this time we walked to maintain an elevated heart rate. After completing the session I sweated quite a lot but didn't feel as fatigued as on Thursday, I put this down to the heat, to replenish the lost electrolytes and salts minerals etc I took some lucozade supplements. Gym sessions have commenced on Monday, Wednesday and Friday, but never fully completed. Monday I felt unwell, Wednesday I hurt my elbow and on Friday my elbow began to hurt again so to aid recovery I decided not to undertake the pec dec for any serious work. On Monday I was also suffering from a sore shoulder – possibly from the cricket game at the weekend – although this didn't directly hinder any progress it was a niggling factor in the back of my mind – felt most evident whilst doing arm curls. I hurt my elbow on the pec dec due to my forearm being sweaty; this caused my arm to slip on rest pads. This occurred part way through the concentric movement, my arm was under a lot of strain at this point and the sudden release caused a sharp pain to radiate through my forearm.

Week 8:

This week I am trying a different method for my sets. I complete two heavier sets of reps in quick succession on each machine before moving on to another machine. This is repeated each time I go to work on the machines that are involved in my PEP. It allows me to lift heavier weights under control they are semi-'super sets'.
My elbow continued to ache so no work was undertaken on the pec dec on Monday except for the 21's which I gauged as an indication to how sore my elbow was feeling. As I didn't believe I'd have much time to run this week I emphasised my cardiovascular work in the gym by doing extra running and rowing – I didn't feel to tired after this just sweated a lot as gym was very hot! On Wednesday I didn't complete a full session as my motivation was lacking and I attempted some exercises on the pec dec and my elbow became sore. I wore some strapping on my elbow for the first set and I believe this helped it, during the second I didn't and it felt sore, thus proving it was supporting my elbow and allowing me to complete sets. I decided not to do anymore sets as the strapping may just be masking my pain! I went to hockey training on Tuesday completing the run in second place (five laps of hockey pitch), this was quite maximal and I began to lag towards the end but attempted to open up, sprinting to finish strongly, we then did some stick work and more running between some cones – this was all hard work but I felt I coped reasonably well. This all made me realise my fitness is still nowhere near last years level yet and I still have a long way to go. (I trained for approx 1½ hours solid) on Friday the gym session was quite a full one apart from the pec dec with which I was still suffering due to my elbow. For this I wore strapping again but stopped for fear of repercussions of my actions and further damage being caused. All of the sets were completed and I believe are becoming easier. I think my new way of completing my sets is a good idea as it allows me to cope with heavier weights – whether this method shall allow me to reap

greater benefits more quickly only time shall tell! On Saturday I played hockey – I was sub but when on the pitch I worked quite hard with an emphasis on running hard and continuously, I found that through the hard running/sprinting my calf's ached – I don't know if this was connected due to me working my calf's a lot in the gym – but I shall attempt to limit the hard leg work I am undergoing. On Sunday after the game I was sore in my legs due to 'opening up' when I was running.

Week 9:

This week I still noticed some pain in my elbow so decided not to test my one rep max and give it more time to heal and recuperate. My other one rep max' are improving in increments of approximately three to four week blocks, although I'm still disappointed with my improvement on the arm curl! On Tuesday I think I over did the physical activity as on Wednesday my whole body felt sore especially my knee and quads region, I believe this to be in part due to the rowing I undertook – of which I don't normally commit myself to for quite so far. I shall have to watch this in the future because if I undergo too much again in one day it could throw my whole schedule off.

Week 10:

My schedule was thrown completely off this week as other commitments prevented me from my usual routine. Also due to the injury to my elbow I felt that it would be best if I cease my PEP, at least for the short term. Hopefully it should give me elbow chance to heal and recuperate as I'm afraid that through using it on the other machines I may still be straining it. I hope to continue the cardiovascular routine which I've had during my PEP to keep going, and possibly revisit my strength training at another suitable time. I shall allow myself at least a full four week rest period – at this point I shall review my progress and whether my arm is capable of intense physical activities. I have also found that I lacked motivation in the last couple of weeks, with pressure of college and fitness for hockey training the strength training programme hasn't been the most important thing on my mind!

Evaluation

When consolidating the success or failure of my PEP I must bare in mind the time frame I allowed myself to complete it within. As aforementioned strength training programmes need a minimum of eight weeks before 'noticeable changes' are expected to occur, my strength training programme was just above this minimum threshold and I also believe that 'noticeable changes' occurred. These changes include an increase in muscle size, proportion and weight, combined with an increase in maximal strength; these changes can all be seen as evidence from my graphs, tables of results and objective opinions.

I believe that due to an amalgamation of positive contributing factors this led me to the desired outcome that I received. The introduction of the ergogenic aid of Soya protein and vitamin supplements I believed benefited my programme. There is evidence that suggests 'high…amounts of dietary protein' can benefit strength training, but the study focussed on intense bodybuilders, it may be debatable whether my programme was sufficiently intense to demand the extra intake. Even if no clinical benefits can be prescribed to the intake which I undertook it would have at least had a placebo effect, i.e. made me feel like it was benefiting and therefore psychologically gave me what I felt was an edge to train harder for longer, with the self confidence that I would be doing myself extra benefit!

During the training period I didn't undertake any other attributes that could have led to an increase in strength apart from the supplements therefore I can conclude that the increases I noticed can primarily be justified by my weights sessions. I believe there's a conclusive link between the specific weights training I undertook and the improvements noticed, proving that I had designed an effective programme. The extra strength has given me greater self-confidence, when in the tackle situation I feel more apt at breaking the game line and being solid in defence, stopping an attacker getting through. The improvements are most noticeable where I turn a tackled player towards our forwards and in dump or wall tackling, this has not only been noticed by myself but also my captain 'you look much more self assured in the tackle situation…he was stopped in his tracks…you turned the man there most proficiently!' (Madden, 2003)

I found that when I started working six days a week during the summer and undertook sporting activities it led to me feeling quite fatigued. I didn't really consider my other commitments when I decided to undertake the programme, the stress levels I was put under also caused me to suffer from a post viral fatigue, I also felt that my immune system was down sufficiently to allow to succumb to a cold more easily than I would have if I wasn't exercising so intensely. So that I was still able to complete my sessions getting up early was a successful compromise so that I maximised my sessions still. This is something I must consider in any future programme else my performances may suffer again.

When in the gym I didn't just use the machines that I was going to analyse my improvements on but I also established other machines which stressed associated muscle groups within close proximity to those that were being tested. This would allow me to

create a more powerful overall upper body. I decided to undertake this as the weights machines I was using predominantly isolated the specific muscle that were targeted. This may have been suitable for just weight trainers but where I wanted to use this extra strength in a sporting scenario it was essential to build up all associated muscle groups not only to help prevent injury but to also create a balanced body.

From my graphs you can see that on all of the machines showed an improvement. The greatest improvements were witnessed on the pec dec. I believe this to be due to an amalgamation of factors; the pec dec was the first machine I started with at the beginning of each session, therefore I was totally focussed on the task ahead, I had nothing to distract me and my concentration was utmost. Secondly I believe that the associated muscle group (pectoralis major etc.) have a lot of scope for improvement i.e. my original one repetition max was only 45Kg, thirdly it could have been that this machine was particularly good at stressing this muscle group and that is why I noticed the greatest adaptations there. This was even more encouraging results due to the fact that I was unable to train for a period of time due an elbow injury, although this may have played upon me psychologically to train even harder when I was back to fitness. You can match on the graph the period of injury as the only time that I had no improvement; if I had no injury I hypothesise that the overall improvements would have been at least 25Kg. In complete contrast the machine with which I started with the greatest optimism for improvement was the bicep curl, but in reality I saw the least improvement. I believed it to be a machine I was in particularly competent with, this was due to in previous training using the machine a lot. This could have been in part my downfall as to why I didn't improve much; psychologically I knew I already had reasonably good bicep strength. I had begun to plateau and even though I attempted to increase my repetitions and sets to no avail I didn't notice any great improvement. This may have been due to the type of training and movement I was undertaking as I had reached my natural threshold of muscle strength in this area. The other two machines that I tested myself on I noticed good improvements, with both having an increase of 10Kg in ten weeks, with a steady rate of increase.

See appendix E for table of results and verification

I believe that the variable resistance machines I used, particularly the ones I tested my self on are designed to target specific muscle groups, specifically with regards to the bicep curl machine. This may explain why I noticed little improvement. In contrast the shoulder press and vertical bench press allowed the utilisation of associated muscles, as stressed on other machines therefore being stressed more often, this should have led to greater improvements, but I don't believe it did. This may have been due to when I did the testing I moved from one machine to the other, not allowing sufficient rest periods, therefore my ATP-PC systems hadn't replenished sufficiently. This would also account as to why the pec dec also showed the greatest improvements as it was the first to be tested.

If I were to undertake the same focus of a fitness programme for the next ten weeks I would ensure that it took president over any other sporting obligations I had, therefore

maximising benefits. Also I wouldn't just complete a straight ten week block of training Sharkey, 2003 suggests that weight training should be completed in cycles of no more than eight weeks, this is to prevent a plateau in performance and maintain motivation. I found from having too many other sporting commitments my previous PEP suffered, this was witnessed when I played American football in my practice week and also where I played a lot of cricket. I believe I would still take a vitamin and protein supplement, if not for the physical benefits than for the psychological. I would also allow greater rest periods between testing and undertaking sessions on the different muscle groups. I would also like to train three times a week with each session having a different emphasis, with Fridays being my 'hard' days (with the weekend to recuperate) and Wednesdays being a relatively easy session. I would also aim to ensure that I didn't have either work or social commitments around the sessions, i.e. when I worked it meant I had to undertake my sessions at seven in the morning, for me, not the most practical timing. Even though, this is a more practical time than in then late in the evening. Ideally as well I would predominantly use free weights with the aid of a qualified instructor and spotter at all times. Due to current research suggesting that the best benefits come from using these machines and that they 'mimic sporting movements' (www.pponline.com) more closely than the variable resistance machines.

The most important difference shall be the incorporation of psychological skills training in helping me enhance my performance; with the principle of 'mind over matter'. It is known that in the modern sphere of sport all the great athletes use psychology to maximise training benefits. I believe it to be paramount in ensuring I maximise each session with 100% commitment to every lift, every session. I aim to visualise each lift, understand how to complete the lift; forwards, backwards, inside out! Therefore having complete control of what I'm doing and therefore complete self-confidence. Also I find that going to the gym with a friend particularly one stronger or more athletic makes me more competitive and the effect of social facilitation takes affect and causes me to raise my game even more, I aim to ride this competitiveness to maximise my sessions.

Session plan 1 (Monday)

| |
|---|
| 3 Km cycle |
| 500m row |
| 21's; undertaken with free weights |
| Warm ups, stretches |
| Visualise next movement |
| Close-Grip Barbell Bench Press |
| Two minutes rest, sit relax |
| Medium-Grip Barbell Bench Press |
| Two minutes rest, sit relax |
| Wide-Grip Barbell Bench Press |
| Another activity e.g. leg curls |
| Visualise next movement |

| |
|---|
| Decline Dumbbell Flye |
| Two minutes rest, sit relax |
| Bent-Arm Dumbbell Pullover |
| Two minutes rest, sit relax |
| Incline Dumbbell Flye |
| Another activity e.g. calf raisers |
| Cool down, relax muscles, have a hot shower |

Tuesday; hockey training, cardio and skills work

Session plan 2 (Wednesday)

| |
|---|
| 3 Km cycle |
| 500m row |
| 21's; undertaken with free weights |
| Warm ups, stretches |
| Visualise next movement |
| Medium-Grip Barbell Bench Press |
| Two minutes rest, sit relax |
| Medium-Grip Push-Up/Bench |
| Two minutes rest, sit relax |
| Incline Dumbbell Flye |
| Two minutes rest, sit relax |
| Dips with Weights |
| 5000m row |
| Cool down, relax muscles, have a hot shower |

Thursday; day off, no weights or cardio work undertaken, complete chores so that they don't interfere with sessions

Session 3 (Friday)

| |
|---|
| 3 Km cycle |
| 500m row |
| 21's; undertaken with free weights |
| Warm ups, stretches |
| Visualise next movement |
| Close-Grip Barbell Bench Press |
| Two minutes rest, sit relax |
| Medium-Grip Barbell Bench Press |
| Two minutes rest, sit relax |
| Wide-Grip Barbell Bench Press |
| Another activity e.g. leg curls |

| |
|---|
| Visualise next movement |
| Decline Dumbbell Flye |
| Two minutes rest, sit relax |
| Bent-Arm Dumbbell Pullover |
| Two minutes rest, sit relax |
| Incline Dumbbell Flye |
| Another activity e.g. calf raisers |
| Cool down, relax muscles, have a hot shower |

Saturday; hockey game for local team, stresses cardio system

Sunday; work, undertake no other physical activity

Gym session plan

- 3 km cycle
- 500m row
- 21's on each machine
    1. pec dec
    2. arm curl
    3. shoulder press
    4. vertical bench press
- complete warm up stretches
- complete one circuit on the machines, following same order as warm up
- Undertake new exercise; of a different region to what is being worked, i.e. leg press or abdominal curls.
- complete one circuit on the machines, following same order as warm up
- Undertake new exercise; of a different region to what is being worked, i.e. leg press or abdominal curls.
- complete one circuit on the machines, following same order as warm up
- Undertake new exercise; of a different region to what is being worked, i.e. leg press or abdominal curls.
- Finish with a different exercise or to emphasise a muscle group you feel needs more specific work – repeat more exercises. This exercise shall finish with a static hold, where I shall notice the maximum benefits – this shall be held till failure.

N.b session plan is flexible; more sets may be included if time allows or if it's needed. During each circuit, breaks may be taken to rest muscle groups as to prevent the effects of 'super sets', which could fatigue the muscles in an unwanted manner. Breaks may include sitting out or completing abdominal curls etc.

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Appendix A

| Classification | Non-dominant (kg) | Dominant (kg) |
|---|---|---|
| Women | | |
| Excellent | >37 | >41 |
| Good | 34-36 | 38-40 |
| Average | 22-33 | 25-37 |
| Poor | 18-21 | 22-24 |
| Very poor | <21 | <22 |
| | | |
| Men | | |
| Excellent | >68 | >70 |
| Good | 56-67 | 62-69 |
| Average | 43-55 | 48-61 |
| Poor | 39-42 | 41-47 |
| Very poor | <39 | <41 |

**Wesson and Wiggins, 1998**

Appendix B; for written protocols see www.netfit.co.uk

Appendix 1

**Table 1.** Comparison of Effects of Aerobic Endurance Training with Strength Training on Health and Fitness Variables

| Variable | Aerobic Exercise | Resistance Exercise |
|---|---|---|
| Bone mineral density | ↑↑ | ↑↑ |
| Body composition | | |
| % Fat | ↓↓ | ↓ |
| LBM | ↔ | ↑↑ |
| Strength | ↔ | ↑↑↑ |
| Glucose metabolism | | |
| Insulin response to glucose challenge | ↓↓ | ↓↓ |
| Basal insulin levels | ↓ | ↓ |
| Insulin sensitivity | ↑↑ | ↑↑ |
| Serum lipids | | |
| HDL | ↑↔ | ↑↔ |
| LDL | ↓↔ | ↓↔ |
| Resting heart rate | ↓↓ | ↔ |
| Stroke volume, resting and maximal | ↑↑ | ↔ |
| Blood pressure at rest | | |
| Systolic | ↓↔ | ↔ |
| Diastolic | ↓↔ | ↓↔ |
| $\dot{V}O_2$max | ↑↑↑ | ↑↔ |
| Submaximal and maximal endurance time | ↑↑↑ | ↑↑ |
| Basal metabolism | ↑ | ↑↑ |

↑indicates values increase; ↓, values decrease; ↔, values remain unchanged; ↑or ↓, small effect; ↑↑or ↓↓, medium effect; ↑↑↑or ↓↓↓, large effect; LBM, lean body mass; HDL, high-density lipoprotein cholesterol; and LDL, low-density lipoprotein cholesterol. Adapted with permission from Pollock and Vincent.[3]

(http://circ.ahajournals.org/cgi/content/full/101/7/828, 2000)

Appendix D; sourced from http://www.askmen.com, 2000

Egg-white omelette with low-fat ham and veggies

What you need:
4 egg whites
4 slices low-fat ham, diced
¼ cup low-fat milk
½ tsp black pepper
1 cup chopped peppers, red onions, mushrooms
Fat-free cooking spray
What to do:
Thoroughly coat a medium frying pan with cooking spray, and put it on medium heat on the stove. Cook chopped vegetables in pan until softened (about 6 minutes). In bowl, whisk egg whites, ham, milk, and pepper, until blended. Pour into frying pan, over veggies and cook until set (about 6 minutes).

Tip:
Use a spatula to lift the edges of the omelette slightly as it cooks, to let the uncooked portions run into the bottom of the pan, and cook.

Grilled chicken breast with lemon and pepper, and grilled veggies

What you need:
6 oz chicken breast
1 tsp olive oil
Juice of ½ lemons, or 1 lemon
½ tsp black pepper, or to taste
½ tsp salt, or to taste
2 tsp finely chopped fresh parsley, or to taste
1 ½ cups big chunk of red pepper, red onion, and asparagus
What to do:
In a bowl, combine the lemon juice, olive oil, pepper, salt, and parsley. Using a basting brush, baste the chicken with the marinade and let sit, covered, at room temperature, for 20 minutes. Meanwhile, fire up the grill to medium-high heat. Wash the brush, as to avoid spreading bacteria, and use it to baste the vegetables with the remaining marinade. Place the chicken on the grill and cook for about 7 minutes on each side, or until no longer pink in the centre. Place the vegetables on the other side of the grill, and cook until softened.

Tuna salad

What you need:
1 can flaked, water-packed tuna, drained
4 or 5 leaves Boston lettuce
1 cup lightly steamed green beans

1 hard boiled egg cut in quarters
3 or 4 slices of red onion
3 or 4 black olives, such as Kalamata
Salt and pepper to taste
Olive oil and red wine vinegar to taste
What to do:
Arrange lettuce leaves on a plate, mound the tuna in the centre of the plate, and surround it with the green beans, onions, olives, and egg. Sprinkle with salt, pepper, oil, and vinegar (try not to exceed a teaspoon of olive oil -- although the fat it contains is the Omega-3, or "good fat" variety, it is fat nonetheless).