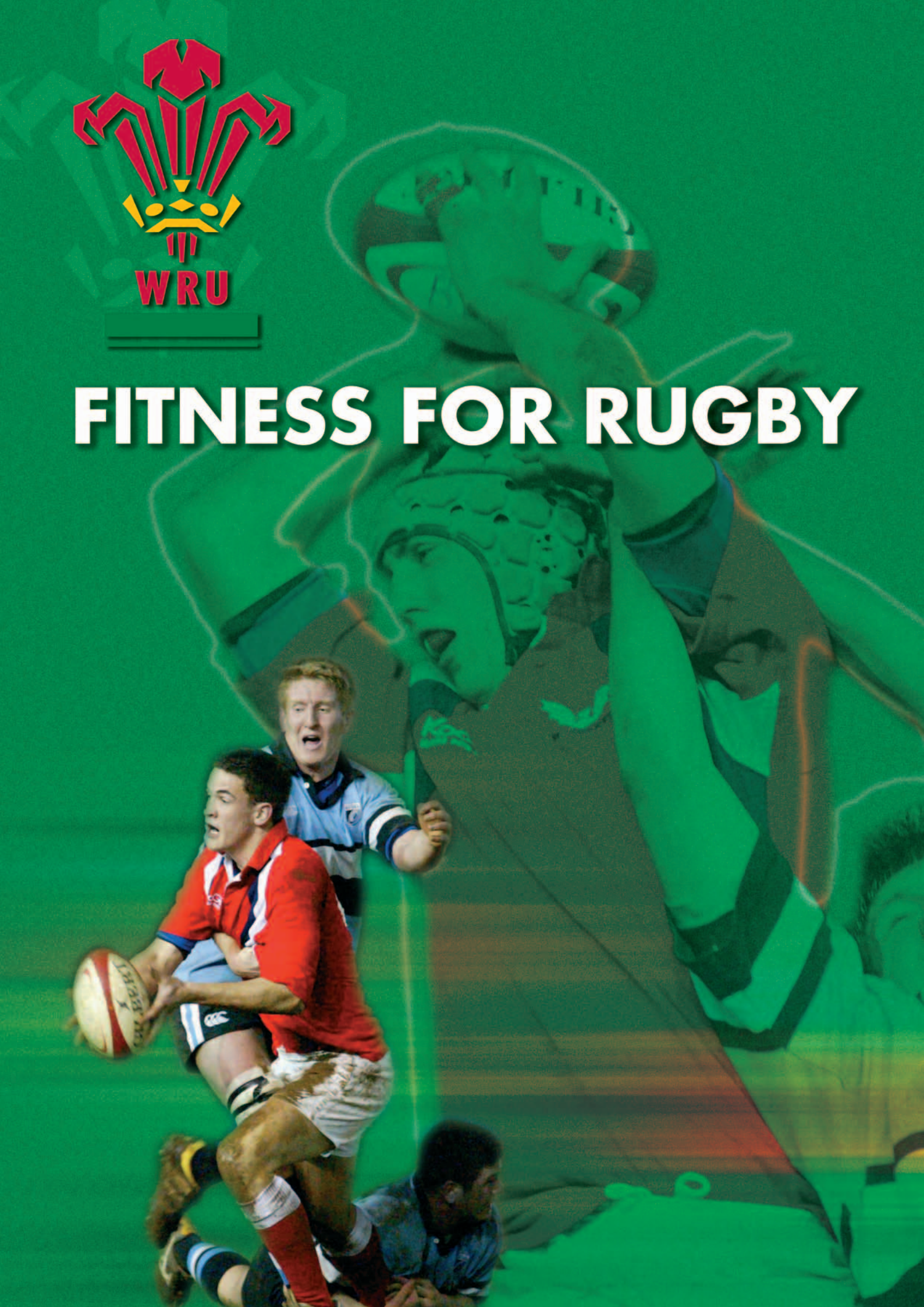
WRU

FITNESS FOR RUGBY



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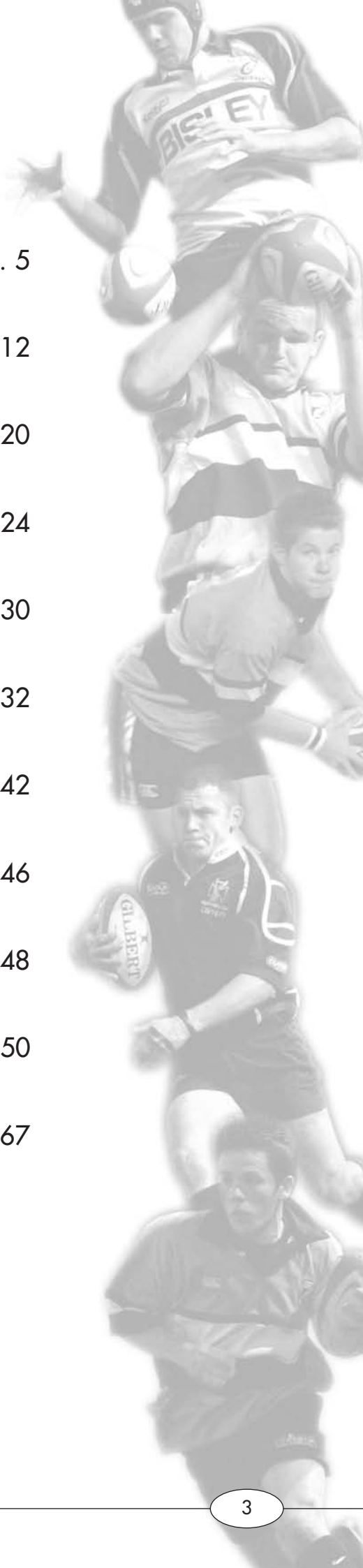


Introduction

Rugby is a team sport which is performed at high intensity for at least 80 minutes. Any team is only as strong as its weakest link during the game, be this skill levels, mental toughness or physical fitness.

The nature of rugby means that players have to have high levels of all aspects of their fitness. They have to work on being fast, agile, evasive and strong but also be able to sustain their contribution to the team for 80min. The strength of a good conditioning plan is that it allows you to be a jack of trades but does not relegate you to being a master of none.

Improving an individual's fitness will make them a better player; they will maintain better skills throughout the game and will improve their ability to read the game and maintain tactical awareness under fatigue. All this will be on top of their capability to perform more work during the game.

The aim of this manual is to provide an overview of the fitness requirements for the modern professional game and to introduce methods and systems that will allow both players and coaches to plan and carry out efficient and effective training programs. The book is aimed at senior level players (over 18 years) who are or who have the goal of maximising their playing ability.

Younger players should read the WRU manual "Rugby fitness for 16 to 20 year olds".

What is fitness?

Fitness can be defined as an individual's adaptation to the stressors or requirements of their chosen sport or lifestyle. The type of fitness required can vary greatly between sports, the more dissimilar the sports and the more elite the participant the smaller the crossover of fitness. This specificity of fitness means that the training you perform for any sport must be orientated towards specific, achievable goals.

Fitness is dynamic; it is always changing according to training status, fatigue, physical health, injuries, nutritional standing and psychological well-being.

Fitness can be split into components - the seven S's:

- Speed is the ability to coordinate simple or complex limb movements at high velocity. An example of a relatively simple movement would be throwing a ball; a complex movement could be an all out sprint.
- Strength is the maximum force an individual can exert through a muscle or group of muscles, against an external resistance.
- Stamina is a measure of the body's ability to maintain a rate of work.
- Suppleness is range of movement through a joint or group of joints.
- Skill is the ability to perform the movements of a sport efficiently and effectively.
- Sustenance or nutrition.
- Psychology in terms of fitness can be thought of as the state of motivation. It can be affected greatly by stressors an athlete can carry into training from work, the family or their social life.

The sport you are involved in dictates the relative merits of each fitness component and the time spent training that component. In rugby this is also true when comparing positions on the field. All positions require a degree of each fitness component but the relative importance of each component will vary according to a player's position.

Principles of training

Individuality

Players can react to the same training stimulus in a different manner; this happens for a number of reasons. The main three causes of this are:

- Genetic - we are all made differently at birth, the limitations of your fitness are set by your parents via the genes you inherit. If both your parents were international class sprinters the chances are that you will have the potential to be a good sprinter. The limitations placed upon each aspect of fitness by your genetics varies, for instance the improvement you can make in endurance is likely to be far greater than that you make in speed. It is important to remember though that you are unlikely to ever reach your genetic limits and should always strive for improvement in all your fitness capabilities.
- Initial fitness levels - we all start at a different level of fitness, a player whose has trained consistently in the past will lose fitness on a program designed for someone learning how to train.
- Maturity - immature players cannot train with the same volumes or intensities as their mature counterpart, which could be detrimental to both their health and overall development. Even so young players can experience huge gains in skill, speed and agility if trained correctly. As players age they are also likely to lose fitness, some of this is due to the ageing process and wear and tear of the game, although a great deal is down to lack of motivation and detraining. As you age variety becomes essential in your plan; it will help maintain enthusiasm and decrease the likelihood of overuse injuries. Players should look to maintain a high level of fitness beyond their playing years for the sake of quality and longevity of life.

Adaptation

Every time you expose your body to a training stimulus changes take place in your body which are designed to make you effective and efficient at the type of work you have performed. Sometimes these changes are chemical - for instance a hard endurance session may jolt your body into producing greater quantities of enzymes for energy production. Other times these changes can be structural - such as the muscle growth produced by weight training. On other occasions still these changes can be neural, that is they will be related to the nervous system and lead to an improvement in your coordination. It should be realised that adaptation can only take place in downtime when no training is performed - hence the need to recuperate between sessions. You must always remember that adaptation is not the same as recovery, recovery takes you to the fitness level you were at before a particular training session, and adaptation allows you to achieve fitness level greater than those prior to a particular session (super - compensation).

Overload

You cannot continue to train at one level and expect progress in your physical conditioning. In order for your fitness to improve you must continually progress the work you perform. The load (volume and intensity) for your sessions must reflect the goal for each session. There are three types of load:

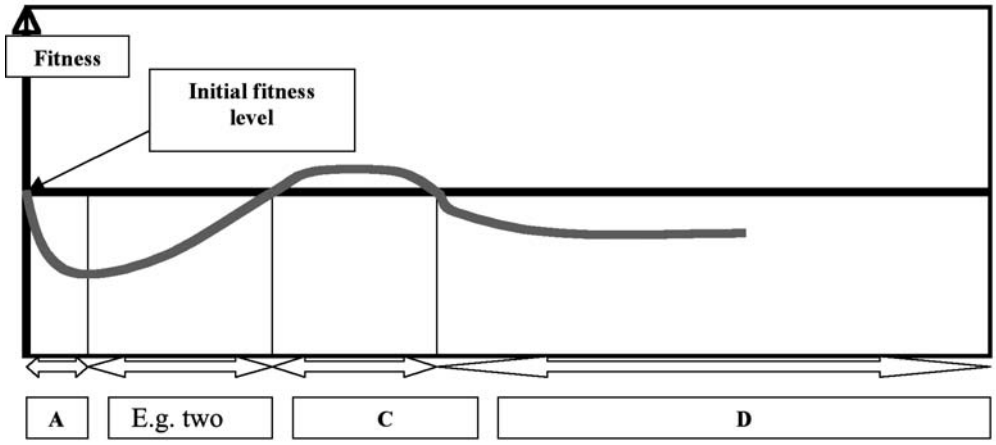
- Training load - the work done in a session is great enough to improve fitness
- Maintenance load - the work done in a session is only enough to maintain fitness
- Detraining load - the load is such that fitness falls even though you perform the session

There are three basic ways to add overload to a session:

- Frequency - adding more session's e.g. Increasing your sprint sessions from 1 to 2 a week.
- Volume - increasing the quantity of work done e.g. running eight 30m sprints instead of six.
- Intensity - increasing the quality of work done e.g. running the same distance quicker.

A generalisation in training is that you use increases in volumes and frequency before you increase intensity levels. To maintain fitness you can lower the frequency of work and the volume but must maintain intensity. It is also true to say that slow and steady is better, the longer you take to achieve a level of fitness the longer you can hold it through maintenance work.

Graphical illustration of Overload, Recovery and Adaptation



A – Workout period, fitness falls away due to fatigue, depletion of muscle fuel etc
B – Recovery period, initial fitness regained as fuel is replaced etc
C – Period of adaptation – body super-compensates to increased fitness
D – Period of de-training fitness level will fall if work not performed

Specificity

As has already been stated fitness is specific and the training you perform must relate to the games demands. A swimming session is unlikely to improve the fitness of an elite rugby player (if timed correctly it may however act as a recovery session - and help reduce fatigue!). This specificity means that training programs must reflect:

- The energy demands of the sport
- The principal of interpersonal and interposition individuality (as discussed earlier)

Variation

Without variation players motivation will fall and staleness and boredom can set in. Lack of variation can be a major cause of underperformance syndrome - an unexplained drop in athletic or playing ability.

Variation in your plan is also essential if peak levels of fitness are ever to be reached. Variation can come in many forms - training goal (e.g. speed or strength), training intensity and volume or exercise selection. Although variation is important it must always fall within the realms of specificity for that sport.

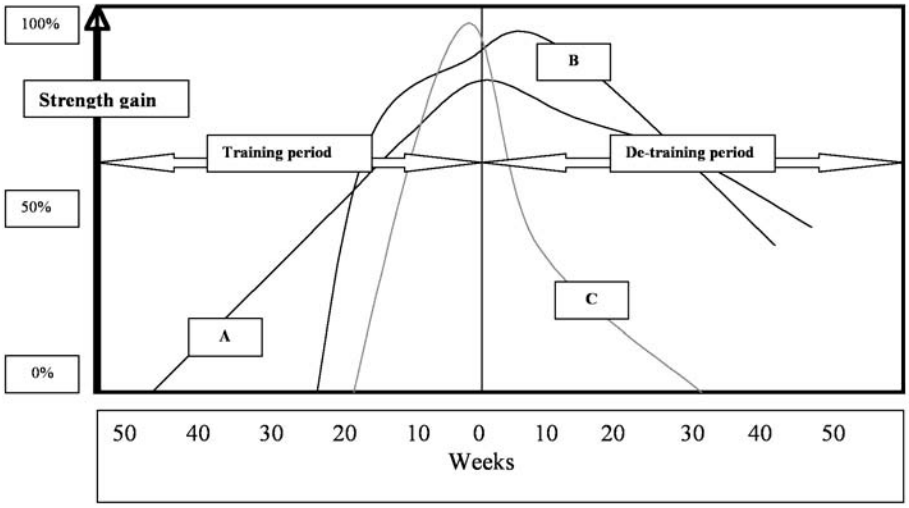
Detraining

Any prolonged lay off from training will be accompanied by a drop off or detraining of fitness levels. The only extended break from training players usually require is 2 weeks of complete rest at the seasons end. This should be followed by a period of general work designed to maintain fitness and improve the player's ability to perform game specific work. Small breaks of 2 - 3 days spaced on 4 to 5 separate occasions throughout the training and competitive season are also likely to be conducive to maximising performance.

There are some very general rules to loss of fitness:

- Neural aspects are maintained longest - aspects of fitness dependant upon the nervous system including sports specific skills will be maintained for a long period of time, any drop off is quickly regained when training is restarted
- Structural changes such as muscle size (remember your heart is a muscle) can be maintained for up to 4 weeks, as long as joint is not immobilised, before dramatic changes start to occur
- Chemical changes such as enzyme production will begin to fall within days of training cessation, these changes have a huge impact upon energy production - meaning even a short period off from injury can influence these aspects of your fitness
- The greater the time you have spent reaching a set level of fitness the slower will be your rate of fitness loss - i.e. slow and steady is better

Graphical illustration illustrating that length of preparation influences rate of de-training. (Taken from *Isometrische Muskeltraining*, Hettinger 1966)



Group A – Trained twice per week
Group B – Trained daily initially then moved to twice per week
Group C – Trained daily

Needs Analysis

A needs analysis is used to help you decide upon the needs of the sport and how you measure up in comparison to these needs. Within a team sport like rugby there is a large variation in the fitness requirements according to position. The needs of the sport/position will determine the fitness tests performed and the levels required to be reached. A needs analysis needs to be performed prior to starting any training schedule, this will ensure that you are training the correct factors required for the sport and you are also training to improve your weakest factors according to your sporting and positional needs. A flaw with many athletes and players who design their own programs is that they will tend to work hard at their strengths and not their weaknesses. The outcome of a well performed needs analysis will be a program which allocates a large proportion of available time to your weakest area whilst still maintaining the stronger elements of your conditioning. Regular reassessment of your needs is required to re-quantify and qualify what your fitness goals are. The fitness standards given in this chapter are your "goals" in a conditioning sense deciding upon your weak points can be more difficult than actually designing a training program. There are numerous ways of making this decision, these include:

- Setting up a statistical point scoring system (T-Tests), for non-professionals this can be time consuming and requires a great deal of initial data
- Comparing your results to team mates in the same position - if you are above average then the aspect is probably a strength, below average it is probably a weakness. The further you are away from the average, the stronger or weaker that element.

Fitness testing

Fitness testing is a must - it is the most effective way of assessing your weakness and confirming the effectiveness (or ineffectiveness) of your training program. The results of your tests will also give you starting points to work out the intensity and volume of work required to ensure progression occurs in your next training cycle.

For a fitness test to be effective it must satisfy certain criteria:

- It is specific and relevant to the needs of the sport
- It is repeatable and reliable - i.e. will the same test produce the same result in 2 athletes at the same fitness level
- It is easy and time efficient to conduct
- The results provided are easy to interpret
- Ideally it can also substitute for a training session in the fitness aspect it measures

The following information provides a battery of tests for assessing rugby players. In some cases alternative tests are suggested if appropriate equipment or facilities are not available.

Acceleration and speed

Must be on a synthetic track, not grass.

Electronically timed over 40m with timing gates at 10m and 40m to measure acceleration, standing 40m time and rolling 30m time (40m - 10m times).

Players to run in running shoes, not spikes.

Ensure a minimum of 20 minutes warm up prior to testing and should include a number of short maximal efforts.

Players should start within 30cm of the light beam (place second line with tape on track, toes must be on this line).

Ensure that the players do not rock back and forth prior to starting.

2-3 attempts are allowed.

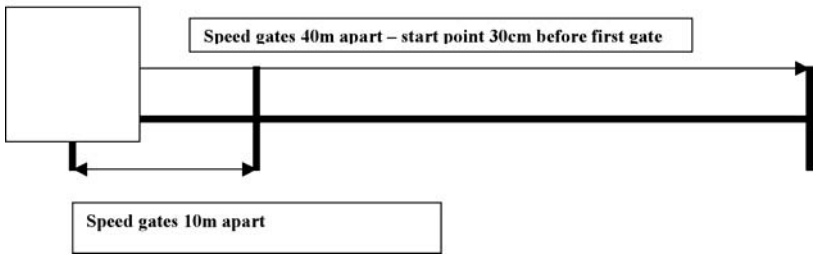
Players should be given ample recovery (minimum of 2-3 minutes) between attempts.

If available use a wind meter. Note wind conditions down if equipment is not available.

If there is any win set up gates so that win is side on or tail wind.

Data required = speed times for 10m, 40m and rolling 30m rounded to the nearest 0.1 second.

Diagram illustrating speed test set up



Aerobic fitness

3000 m time trial:

This is the preferred option for measuring aerobic fitness.
Preferably run on a synthetic track, if one is not available then grass will suffice.
Call split times each lap to allow pace judgement

A predicted VO2 max can be determined using the following formula:

VO2 max = ((2.9226 + (0.89 x km/h*)) x 3.5)
* km/h = (3.0/3000m time in sec.) x 60 x 60

20m multistage shuttle run (Beep test):

This is the alternative to the 3000m time trial.
Perform indoors on a non-slip surface.
Ensure that 2 lines are marked on the floor 20m apart.
Players run back and forth in time with the beeps.
Ensure that players must at least step on or over the line before starting each shuttle.
Players must continue to stay in time with the beeps.
Test ends when players fail to reach the line on 2 consecutive beeps.
The number of the final shuttle completed is recorded from which a predicted VO2 max can be determined.

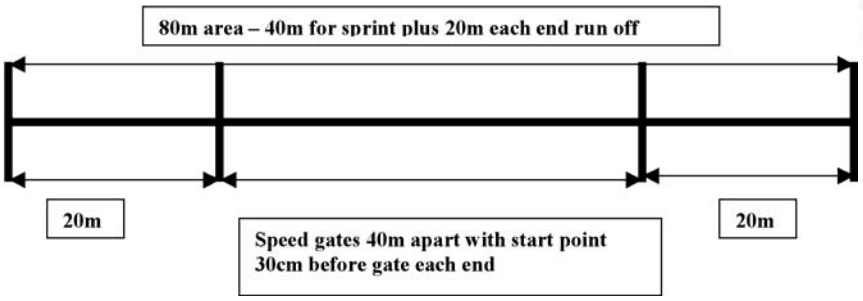
Anaerobic endurance

Phosphate Decrement Test:

This is the preferred anaerobic test.

Preferably to be run indoors or on a synthetic track, if neither is available then grass will suffice.
10 x 40 m sprints run on a 30 second turnaround, with a 40m jog recovery between repeats.
Electronically timed.
Ensure a minimum of 20 minutes warm up prior to testing if this is the first test of the day.
The warm up should include a number of short maximal efforts.
Players should start within 30cm of the light beam (place second line with tape on track, toes must be on this line).
Ensure that the players do not rock back and forth prior to starting.

Diagram illustrating phosphate decrement test set up



Set Up for PDT

If 2 sets of timing lights are available:

Set up two sets of timing lights side by side.
Light gates should be 40cm apart.
Place second line with tape on track 30cm back from light beams in each lane at opposite ends.
Two players line up in separate lanes at opposite ends of the track.
A master timer starts the players on each repeat. They start a stopwatch on the first repeat and start the players every 30 seconds until ten repetitions are completed.
Players sprint down the two lanes 40m as fast as possible. They run through the end gate then jog/walk around a cone 20m past the light gates. They jog/walk back to the start of the opposite lane to the one they have just run down and prepare to start again.
A recorder notes the time taken to run 40m for each player and resets the timing recorder ready for the next repeat.
If you wish to run four players at once, then the next two players start 15 seconds after the first two.
Players must be encouraged to give maximum effort on the early repeats to obtain valid results.

If only 1 set of timing lights is available:

The set up is the same as above, however the same lane is run in for each repeat.
The recorder will need to swap the plugs over in the timing recorder after each repeat.
2 players can be run at once, with the second player starting 15 seconds after the first player.

Expressing Results of PDT

Data is best presented in a table with each 40m time to the nearest 0.1 second for all 10 repeats. From this data the following information can be obtained:

Fastest PDT, Slowest PDT, Mean PDT, Fastest PDT compared with 40m sprint and % Fatigue.

Comparing the 40m standing sprint time with the Fastest Decrement repeat gives a good indication of the effort made by each player in the first repeats of the PDT. By dividing the players 40m sprint time by the fastest repetition of the PDT (Stand 40m Time/PDT Fastest) x 100 will give a percentage value. This value should be <97%.

% Fatigue gives an indication of how much the player fatigued or dropped off over the 10 repeats. This is expressed as a percentage and is obtained by:

((PDT Slowest - PDT Fastest)/PDT Fastest) x 100

Mean PDT is simply the average of all 10 repeats.

Strength assessment

It is important that athletes training history is taken into account to determine the method of strength assessment that is used.

For all professional players and those players who are experienced in strength training the best method is Repetition Maximum Testing.

For younger or less experienced players fixed weight testing should be used initially until those players are comfortable with lifting heavy loads.

3-5RM Testing:

This assesses a player's ability to lift a near maximal load for a low number of repetitions, from which a predicted 1RM can be determined.
Aim to complete a 3-5RM.
If the players fail to complete 3 repetitions or do more than 5 then they should attempt another lift but only after a minimum of 5 minutes rest.
In the baseline testing you may wish to test at 5RM and closer to the season test at 3RM.
Warm up on all lifts with 2-3 sets at a lighter weight.
One of these sets should be at a load close to maximum.
Use Olympic bars and plates only with light collars.
Lifts must be in a controlled manner through full range of movement and must be stopped if a player no longer maintains correct technique.
A spotter or spotters should be available for all tests.

The lifts to be performed, the order in which they are to be performed and key points of form are:

Bench Press:

Carried out on a flat bench.
Feet may either be placed up on the bench or flat on the floor.
If feet are on the floor ensure players do not have excessive back arch when lifting.
Excessively wide grip is not allowed.
Bar to touch chest lightly, avoid bouncing off chest.
Elbows should be fully extended but not locked at the end of each lift.

Equipment for Bench Press

Bench Pull:

Assess back strength.
Players lie prone (face down) on bench.
Knees bent to 90 degrees, ankles crossed with feet up in the air.
Hips, knees and chin must be kept flat on bench, with no rocking during lifting.
Similar grip width as with bench press.
Players lift weight up to touch the underside of the bench.
(should be approximately 90 degrees at the elbow).

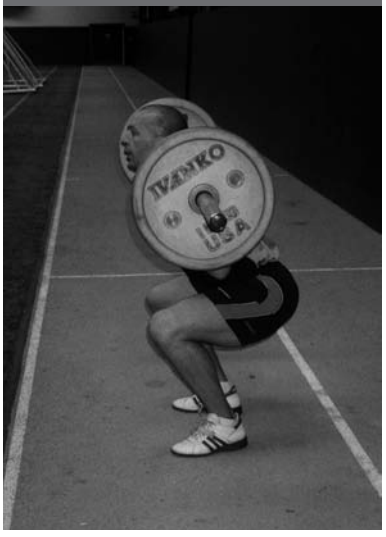
Equipment for Bench Pull

Squat:

Free standing squat (not on Smith machine).
Player must lower in a controlled manner until the top of thigh parallel with the floor (knees flexed up to 80 degrees).
May use bungee cord or elastic band across rack which can be adjusted for each player to lower to, to indicate appropriate depth.
Players must be proficient with form before attempting heavy squats.
Weight belts must not be used.

Start Position Parallel Squat

Low Position Parallel Squat



Finish Parallel Squat

For each test:

The weight lifted and number of repetitions performed can be used to calculate the players predicted 1RM using the following formula:

1RM = WEIGHT LIFTED/({[EXP (-0.055 x REPS COMPLETED))] X 41.9 + 52.2}/100

Rev. Grip Chin:

This exercise is performed to failure with players completing the maximum number of repetitions that is possible.

A shoulder width reverse grip (palms facing towards face) is taken while standing on a chair (once set the chair is removed).
Players commence with arms fully extended knees bent to 90 degrees and ankles crossed.
Chin must be over bar for each repetition.
Arms must be fully extended at the bottom of each lift.
Place arm in front of players' thighs to prevent swinging.
Do not use wraps or straps.

Anthropometrical measurements

Body Weight

Scales should be calibrated at a minimum of every 6 months.
Data required = weight in kg rounded to nearest .1kg.
Ensure that timing of weighing is consistent.
Players should all be weighed in minimal clothing preferably shorts only or shorts and tee shirt.

Skin fold Measurement

Sum of 8 sites is the preferred measurement.

Chart showing lap times for 300m time trial

TARGET TIME	LAP 1	LAP 2	LAP 3	LAP 4	LAP 5	LAP 6	LAP 7	FINISH
10.30	1.24	2.48	4.12	5.36	7.00	8.24	9.48	10.30
10.45	1.26	2.52	4.18	5.44	7.10	8.36	10.02	10.45
11.00	1.28	2.56	4.24	5.52	7.20	8.48	10.16	11.00
11.15	1.30	3.00	4.30	6.00	7.30	9.00	10.30	11.15
11.30	1.32	3.04	4.36	6.08	7.40	9.12	10.44	11.30
11.45	1.34	3.08	4.42	6.16	7.50	9.24	10.58	11.45
12.00	1.36	3.12	4.48	6.24	7.60	9.36	11.12	12.00
12.15	1.38	3.16	4.54	6.32	7.70	9.48	11.26	12.15
12.30	1.40	3.20	5.00	6.40	7.80	10.00	11.40	12.30
12.45	1.42	3.24	5.06	6.48	7.90	10.12	11.54	12.45
13.00	1.44	3.28	5.12	6.56	8.00	10.24	12.08	13.00
13.15	1.46	3.32	5.18	7.04	8.10	10.36	12.22	13.15
13.30	1.48	3.36	5.24	7.12	8.20	10.48	12.36	13.30
13.45	1.50	3.40	5.30	7.20	8.30	11.00	12.50	13.45
14.00	1.52	3.44	5.36	7.28	8.40	11.12	13.04	14.00

Fitness standards for aspiring professionals

Position	3000m	PD average	10m sprint	40m sprint	Bench press KG	Bench pull KG	Squat KG
Fullback	11.54	5.67	1.69	5.09	132	107	171
Wing	12.10	5.67	1.69	5.03	127	105	186
Centre	12.19	5.55	1.65	5.08	139	110	179
Halfback	11.50	5.4	1.73	5.19	131	102	176
Back-row	12.19	5.46	1.75	5.37	139	114	194
Second-row	12.34	5.99	1.78	5.50	137	113	185
Hooker	12.37	5.99	1.79	5.49	144	114	203
Prop	12.50	6.00	1.81	5.63	155	121	223

Designing your programme

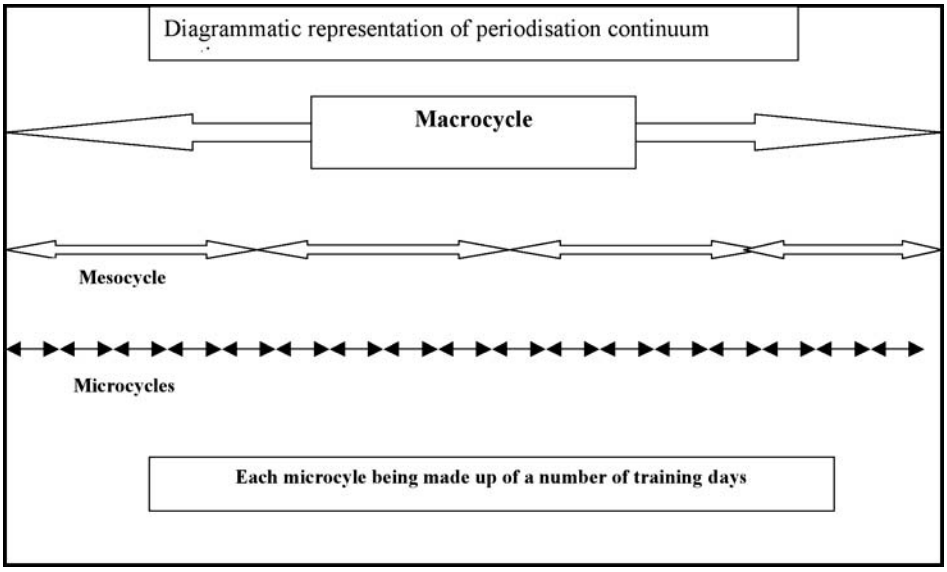
The planning of your program has to take into account a number of variables; these include your age, training experience, long term and short term goals, facilities and resources available. Within the scope of this publication we will consider only a general years plan and use it to illustrate the principles of planning.

The nature of the rugby season means that players physical development is planned on a yearly basis, some individuals may plan over a longer period e.g. a developing youngster or a player aiming to compete at a world cup (a 4 year plan). A yearly plan will obviously cover 52 weeks, within this time frame all aspects of fitness need to be developed, maintained whilst the development and maintenance of each component should not interfere with a players ability to compete in season. This planning process is generally known as periodisation. In producing a periodised plan the rugby year is generally split into 3 phases:

- **Off season** - this period starts after the last game. In rugby it would generally last 4 weeks, during this period the aims of each player should be to physically regenerate and recover after the season (up to 2 weeks rest) whilst minimising fitness loss with cross training, non specific gym work and other activities such as bike riding, tennis etc.
- **Pre season** - or preparation phase, this is the period for most players when high volumes of work are performed in an attempt to improve conditioning. In real time this generally equates to about 12 weeks.
- **In season** - the competitive period where games are played, this will last approximately 36 weeks. In many sports the competitive period is relatively short and athletes simply look at maintaining fitness. In a team sport such as rugby the pre-season period is too short to have a large impact on fitness of elite players. The length of the season also means that fitness levels are likely to drop off if only a maintenance program is followed. This means that in-season training for a rugby player will involve a balance of periods of fitness development, maintenance and recovery time.

It is useful to be familiar with the terminology that is commonly used in periodising sports training plans, there are descriptive terms which are used to define and identify time frames within plans:

- **Training session** - this is generally the smallest time frame and is self explanatory - describing the content of one individual workout
- **Training day** - will contain one or more training sessions which are carried out on the same day
- **Microcycle** - a Microcycle is a group of training days - for convenience a microcycle will generally follow the calendar and last 1 week.
- **Mesocycle** - a group of Microcycles - it will normally consist of 4 to 6 microcyles planned to produce effective fitness gains. In rugby the off season would generally be 1 Mesocycle long, the pre-season 2 to 3 Mesocycles and the competitive season 6 to 9 Mesocycles in length.
- **Macrocycle** - the largest division used and is an overall view of the plan it can be up to 4 years long, in most team sports it will cover the off, pre and competitive season and be 12 months in length.



When putting your plan together it is important to consider these divisions for the following reasons.

1) Training sessions within a training day should be planned so as to minimise fatigue carryover from 1 session to the next. The same is true within a microcycle, work which requires an athlete to be fresh, needs to be planned for the early part of the week - when no fatigue is present. If this type of work needs to be carried out later in the microcycle, after fatigue producing work, then recovery periods or sessions need to be performed to improve the effectiveness of the plan. Periods and sessions for recovery also need to be programmed in at the end of each microcycle to ensure athletes are not carrying excessive fatigue into the start of the next week.

2) Training is generally far more effective if a mesocycle attempts to develop 1 or 2 at maximum, aspects of an athlete's fitness, whilst simply maintaining the other fitness facets. This means that each microcycle will attempt to progress on the work carried out in the previous microcycle. The last microcycle in mesocycle is often planned as an easy week to allow fitness gains produced from training to manifest themselves (adaptation) prior to the commencement of the next mesocycle.

3) There is no reason why consecutive mesocycles cannot be planned to improve the same aspect of fitness if it is considered a weakness or extremely relevant to the athletes position or needs.

4) Mesocycles and macrocycles should be planned in a manner which produce the greatest gains; a good example would be a mesocycle concentrating on power development being carried out prior to a speed cycle. The gains produced in the power cycle being conducive to speed development. A poor example would be placing a mesocycle designed to produce improvements in aerobic capacity prior to one intended to increase muscular size (hypertrophy). The increase in aerobic capacity being lost as muscular mass increases (a far more effective plan would be to increase size whilst trying only to maintain aerobic capacity, then to improve aerobic capacity in the following cycle while maintaining muscular size). The following table attempts to illustrate factors which train well together and also which factors lead and follow each other effectively (remember even when not trying to develop a fitness component you must always try to maintain it - irrelevant of the goals of a particular cycle);

Fitness component	Comment
Speed and agility	Can be cycled well with power work, a power cycle prior to a speed cycle is effective. Attempting to develop speed concurrently with endurance inhibits speed development. Power will fall during an endurance cycle - so following an endurance cycle with speed development is ineffective.
Power	Again impacted on by endurance work, works well with strength and speed work. Ideally precedes speed cycles and follows strength cycles.
Strength	Is difficult to develop concurrently with endurance is not inhibited by speed or power work, residual fatigue from strength session can inhibit power and speed development
Anaerobic endurance	Development is unlikely to be inhibited by other training factors - unless residual fatigue is carried into a development session.
Aerobic endurance	Development is unlikely to be inhibited by other training factors - unless residual fatigue is carried into a development session

From the above table it can be seen that endurance work does interfere with the development of other important fitness aspects, the fact that rugby is a high intensity sport played over 80mins or more means however that endurance development can not be neglected and maintenance is essential even during periods of speed, power and strength development.

5) As already discussed the content of a microcycle and mesocycle will need to take into account the time of season;

Off season work needs to be non specific and of low volume and intensity, this will allow the body to recover whilst minimising fitness losses.

Preseason work needs to cycle both periods of high intensity and high volume as this is the most effective way of producing fitness gains.

In-season work should be generally med to low volume to ensure players are free from fatigue when they play, volume can be raised during periods in a season where no or unimportant games are played, intensity should remain relatively high. To create a peak in performance a high volume period needs to be followed by a decrease in volume and an increase in intensity.

A Generalised Macrocycle Rugby Union

Month	M	J	J	A	S	O	N	D	J	F	M	A
Period	Off - season	Pre-season			In-season or competition period							
Aerobic work	Develop		Maintain									
Anaerobic work	No specific	Develop			Maintain - attempt to develop if periods of inactivity are present							
Strength	Non - specific	Strength endurance	Max strength	Rate of force development	Maximum power	Speed strength	Max strength	Rate of force development	Maximum power	Speed strength	Maintain	
Speed	No specific work	Emphasis on technique		Top end speed	Acceleration	Agility	Game specific					
Volume	Low	Trend high start lowering towards season			Volume will be lower than pre-season but may increase during periods of downtime/injury or non-competition games intensity need to remain high will decrease if volume increases							
Intensity	Med	Trend med increasing towards season										

An example of a Microcycle in Preseason with anaerobic development as the goal

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
AM	Speed and acceleration	Anaerobic short intervals	Whole body strength	Recovery day	Anaerobic long intervals	Skills	Recovery day
PM	Whole body strength		Aerobic cross training		Upper body strength	Anaerobic games	

An example of a Microcycle in pre-season with speed and agility development as the goal

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
AM	Speed and acceleration	Speed and agility	Strength maintenance	Recovery day	Speed and agility	Strength maintenance	Recovery day
PM	Power followed by skills	Skills	Short anaerobic intervals		Power followed by skills	Anaerobic games	

An example of an in-season maintenance cycle

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
AM	Speed and skills	Skills	Strength maintenance	Power	Team run	Game	Recovery day
PM	Strength maintenance	Anaerobic	Skills		Pool recovery	Pool recovery	

Endurance

Endurance can be thought of as a body's ability to maintain workload; energy production is required for this work, generally the more efficient and effective an athlete's energy production - the better his endurance. There are two main energy producing pathways available:

- Aerobic energy production - the production of energy via pathways which utilise oxygen.
- Anaerobic energy production - the production of energy via pathways that do not directly involve oxygen.

Aerobic Energy System

Aerobic energy production alone will only support activities of moderately high intensity, despite this it is important to remember that the greater your ability to produce energy via the aerobic pathways the harder you can work without anaerobic energy production dominating your work capability. The side effects of aerobic endurance are very beneficial to health - training causes an increase in the size of the heart chambers and reduces resting heart rate and blood pressure, all of which make for a more efficient cardio-respiratory system, which enables the body to handle a greater amount of physical stress and develops a healthier body.

Aerobic training

Numerous methods to train the aerobic system exist most of which involve whole body stamina type activities. These activities can range from traditional running exercise to more gym based activities such as rowing, swimming and cycling. Depending upon your fitness levels these may not have a carry over into your rugby fitness - the better your condition the less likely they are to improve your rugby fitness. They will always however provide variety, are beneficial for your health and aid in weight control and are especially useful in times of injury rehabilitation.

Any activity that elevates the heart rate to approximately 60 - 80% of its maximum level (220 beats - Age +/- 10 beats) for a sustained period (20-40 minutes), builds the aerobic base. The actual heart rate you are required to maintain to build on your aerobic ability depends upon your fitness, the higher your fitness level the higher the heart rate you will be required to achieve. Coaches and players should learn to measure the heart rate accurately. This can be done easily by using a heart rate monitor or by taking a radial pulse. Place your finger on the underside of the wrist in line with the base of the thumb. Count the number of beats for 15 seconds, and then multiply by four to give an estimate of the heart rate per minute.

Aside from the physiological benefits of aerobic training, the added benefits for those involved in rugby include:

- Aerobic endurance can serve as a base for players to work from and develop other components of fitness.
- Aerobic endurance accelerates the rate of recovery in rest periods during the game and after intensive training and matches.

- By delaying the onset of fatigue it will help maintain concentration, focus and decision making for players.
- Players who have a good endurance base will utilise greater quantities of energy from fat stores prior to using energy in the form of muscle glycogen (sugar stored in the muscle) helping to delay the onset of fatigue.

An aerobic training programme should involve a series of timed measurable activities. Players should try to reduce the time taken to achieve the specific distance or increase the distance covered in a set time. In addition to long distance runs, players who wish to improve their aerobic endurance should be encouraged to undergo Fartlek running sessions.

Aerobic training methods

Continuous steady state exercise

This involves exercising at a constant pace for a minimum of 20 minutes, if we remember the rule of specificity running is probably the most effective training mode for rugby. Continuous steady state running should generally be limited to off season and early pre-season work, or on occasions such as resuming training after a lay off or injury. For recreational players a heart rate of between 65-80% of your maximum heart rate is a goal, for serious trainers or professional players higher heart rates should be maintained.

In order to progress your work you should first gradually increase the volumes of work you perform, (number of runs per week, or distance of runs) you should then aim to increase the intensity of your runs (running speed).

Most players would never need to perform more than 3 of these sessions weekly; the more advanced your fitness the lower the likelihood of you needing to perform this type of work.

This type of work will increase the volume of blood your heart can pump during each beat (lowering your heart rate at rest and at specific workloads) as well as increasing the oxygen carrying capacity of your blood and the volume of blood within the system. It also allows your body to become more efficient at burning fat as an energy source, prompts your body into increasing capillaries (small blood vessels) to the muscles and increases the capacity of muscles to utilise oxygen.

Fartlek

Fartlek derives from the Swedish language and can be translated as speed play. During a Fartlek session you vary your pace from fast running to slow jogging. It is more specific to the needs of the game so is likely to have a greater effect on your playing performance.

Physiologically it will produce the same results as continuous steady state work as well as improving your running economy (i.e. you will not need to work as hard to maintain the same pace) and will also have a more pronounced effect on your anaerobic system (depending upon the speed and intensities you achieve).

E.g. of a Fartlek session:

1. Jog 5 minutes
2. Fast even paced run for 3 min
3. Jog for 3 min
4. Running even paced for 3 minutes with 4 or 5 fast bursts
5. Jog for 3 min
6. Hard runs for 1 minute (e.g. uphill) interspaced with 1 min walks - 5 reps
7. A cool down jog of 5 minutes

The variation you can achieve is endless and the quicker the runs you can initiate into your sessions the greater the game related benefits.

Interval training

Intervals consist of a series of runs over a specified distance with a set recovery between them. The session becomes more effective if active recovery - in the form of walking or jogging is undertaken. Interval training will produce the benefits associated with other types of aerobic work and will also improve lactic acid tolerance as well as increasing the body's ability to deal with lactic acid. There are a number of variables which can be manipulated to produce variation within interval programs:

- Interval length - for aerobic work for rugby the interval length will generally vary from 50 to 1500m. As you get closer to the competitive season you would generally decrease the length of the interval.
- Interval pace or intensity - generally the shorter the interval the higher the pace, if you cannot maintain pace throughout the session then you have set too fast a pace and are probably developing your anaerobic system.
- Repetitions in a session - the longer the interval distance the fewer the repetitions, you will generally need a minimum of 15 minutes of work time in a session and up to 25 minutes.
- The length of the rest interval - for developing aerobic endurance your work to rest ratio needs to fall between 1:1 and 1:2. The shorter the interval the greater the ratio of time spent recovering.

Examples of aerobic sessions

	Reps	Sets	Intensity	Rest
5000m run	1-continuous	1	70-85% max heart rate	NA
3000m run	1-continuous	1	70-85% max heart rate	NA
1000m runs	4	1	5 - 10% faster than 3km pace	2 to 4 min recovery between reps, increases as you get faster
400m runs	10	1	70-80% of pace for best 400m	1 to 2 min
100m runs	6	3	70-80% of best 100m pace	50m slow jog between reps 3 minute between sets

Progression of aerobic training

There are some simple rules which you can follow that will allow you to effectively improve your aerobic performance:

1) Start with continual exercise modes, move towards Fartlek work and eventually intervals. The interval distance will decrease as you approach the season but the pace will increase. One to two interval sessions per week mixed in with other work is sufficient.

2) On a weekly basis do not increase the volume (distance) of your work by more than 10%.

3) Increase volume before you increase intensity.

4) Do not increase more than one variable on a weekly basis (either volume or intensity).

5) A trend should show your weekly intensity increases as volume falls.

Anaerobic Energy System

Anaerobic energy is produced via reactions which do not directly involve oxygen. In very intense exercise it provides a high proportion of the energy requirements. Intense exercise can only carry on for a limited period because anaerobic metabolism produces a by-product known as lactic acid. Lactic acid build up in the body produces pain and slows down chemical reactions in tissues - both of which mean exercise intensity has to fall off for the body to recover. In recovery lactic acid which is produced during anaerobic metabolism is fed into the aerobic system and used for energy production. In low intensity work the aerobic system is able to 'mop up' all the lactic acid produced, as intensity levels increase the anaerobic system provides a bigger contribution of energy and more lactic is produced which eventually builds up in the tissues.

It is important to realise that the anaerobic and aerobic systems are not switched on and off but are working at all times - it is the proportion of energy they each supply which varies. As work rate increases lactic acid is produced faster than it can be fed into the aerobic system and concentrations in the active tissues rise. The point at which this occurs is called the Onset of Blood Lactate Accumulation or the Anaerobic Threshold. Below this point people generally call the work aerobic, above it anaerobic.

An efficient aerobic system will raise the amount of work that can be done before the anaerobic threshold has been reached, it will also allow a quicker rate of recovery from this type of work. Anaerobic training will have 2 effects on the body - it will allow more anaerobic energy to be produced at any point (anaerobic capacity) and also improve the body's tolerance to lactic acid (anaerobic endurance).

The fact that rugby requires frequent high intensity periods of activity interspaced with recovery periods means anaerobic fitness is a cornerstone of your playing potential. Rugby is also chaotic in that neither the intensities nor durations of the activity or recovery can be predicted, which means training sometimes needs to be chaotic.

Anaerobic endurance training methods

Anaerobic work usually takes the form of interval training. In order to develop the anaerobic energy system the intensity of the work needs to be very high, athletes should look to reach a heart rate of 85-100% max during the work period. Because the intensity is so high recovery to work ratio needs to be relatively higher than aerobic sessions. Generally the rest to work ratio is between 3:1 and 5:1, as with aerobic work the more intense (shorter) the interval the greater the ratio of rest to work time. Duration of intervals is usually set between a continuous 5 to 40 second period (occasionally longer).

Phases of the training year set aside for anaerobic training will normally commence with intervals of longer duration and sequence towards shorter more intense rugby specific work times.

As in aerobic training game specific work is the most efficient way of improving your rugby fitness, shuttle runs, relays and anaerobic team games are all good ways of performing anaerobic workouts. This does not mean that activities such as rowing, biking and circuits do not have their place in the yearly training plan.

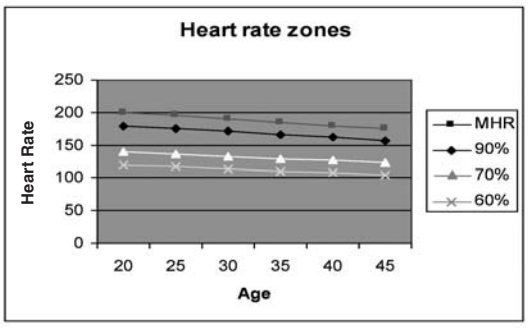
Examples of anaerobic sessions:

Exercise	Reps	Sets	Intensity	Rest
RUNNING				
300m run	4	2	50 secs	3 mins walk between reps, 10 mins active movement between sets
200m runs	6	2	35 secs	2 mins walk between reps, 10 mins active movement between sets
150m runs	4	3	22 secs	2 mins walk between reps, 5 mins active movement between sets
Hill runs	8 x 1 min up and down short, steady slope	3	100% up the slope jog down	1 minute between reps, 5 minutes active movement between sets
ROWING				
300m row 150m row	5 x 300m, 3 x 150m	2	300m = 1.20 min 150m = 40's	45's rest between 300m reps, 30s rest between 150m reps
500m row 200m row	2 x 500 4 x 200	3	500m = 1.50 min 200m = 1 min	45's rest between 500m reps, 30s rest between 200m reps

Progression of anaerobic training

The rules which govern the progression of anaerobic training are similar to those that determine the progression of aerobic work:

1) Start with longer intervals, if you are finishing an aerobic schedule then these may be the same length as your short aerobic intervals, they will need to work harder (run faster) during the work periods so your rest intervals will need to be lengthened.
2) Increase volume before you increase intensity.
3) Attempt to lower the working periods but increase the work intensity with time.
4) Do not increase more than one variable on a weekly basis (either volume or intensity).
5) As your weekly intensity increases your volume should decrease.



Flexibility

Flexibility is an important part of the fitness requirement for any sport - lack of flexibility can frequently be a cause of injury, it can also be responsible for poor technique which will inevitably impinge upon performance. Rugby players generally require good flexibility in the hips, hamstrings, lower-back, shoulders and ankles. This flexibility will improve stride length and arm drive for sprinting as well as reducing soft tissue injuries. It should also be remembered that flexibility is specific to the sport; excessive flexibility can also be a cause of problems.

For the sake of simplicity we can split our flexibility sessions into 2 separate areas;

Static - this is the traditional type of stretching athletes carry out it involves lengthening a muscle and holding it in place for a period of time that varies from 5 secs to a minute. These individual stretches can be carried out 3 to 5 times to improve flexibility in a muscle. Static flexibility sessions should be done as specific workouts or as part of a recovery session, there is evidence that suggests static stretching prior to a competition or speed/strength session can actually be detrimental to performance. Stretched muscles may contact more slowly, weakly and with less co-ordination. It has also been suggested that developmental static stretching directly after a competition or session can increase the energy required to recover from that work - and hence lengthen recovery time, as a rule conduct static sessions either 2 hours prior to or after other workouts.

Dynamic stretches - this type of stretch is simply a movement which mimics part of the exercise you are about to perform (example high knees prior to a speed session), you would generally start with small low intensity movements and increase the range of motion and speed of movement as the body warms up. They are very effective at preparing the body for work and have not been associated with the decreases in performance that static stretches are said to produce.

It should always be remembered that stretching can only occur safely after the body has been warmed up - a period of jogging or other low intensity exercise should be used to increase heart rate and body temperature prior to both dynamic and static flexibility work.

Strength and Power

What is strength and what is power?

Strength is a measure of the maximal force a muscle group can apply during a particular movement. It takes no account of the time taken to exert that force. Power relates not only to the force of movement but also to the time taken for that force to be applied. The strongest person is therefore the person who is able to apply the most force. The most powerful person is the one who can apply the most force in a given time frame. For this reason, "power" in an athletic sense is often described as "speed strength" - a measure of how fast the athlete can apply his or her strength.

Why do we need to increase strength and power?

Quite simply strength and more specifically power are needed to run faster, jump higher, push harder, beat the opposition player, and so on. Before being able to develop a power programme, players must have a sound base of strength. Initially upon starting a training plan strength work alone is likely to produce power gains. Eventually specific power work will need to follow each strength training period, periods of strength work will aim to improve maximum force production, and periods of power training will then attempt to allow players to produce these strength reserves in shorter times - and thus become more powerful.

Strength training is also an essential part of the conditioning phase of our training in order to reduce injury risk, and enable the muscles to train harder. Research has shown that significant increases in strength and power are possible just through training the body to use its muscles more efficiently. By far the most effective method of improving your strength is resistance training where body weight or external implements are used to load muscle movements and create muscle stress. Free weight training is probably the preferred method for strength gain for sports, using free weights you are able to mimic the movement patterns and balance requirements for sport - you are unable to do this on most machine type apparatus. Weights lifting exercises that demand high force production, dynamic movements and include a co-ordination pattern that involves more than one joint moving are the most effective for rugby. Photographs illustrating these exercises can be found at the end of this chapter.

The most common method used to increase strength is via resistance training. Power training is commonly carried out via two methods - resistance training and plyometric training.

Strength training

How does strength improve?

From the earlier definition we remember that strength is the ability to produce or resist force with no limit upon time. Strength can be discussed in two ways Absolute and Relative. Absolute strength simply states how strong you are irrelevant of your body weight. Relative strength compares your strength with your body weight. Players with the best relative strength tend to be the best athletes - they are more efficient at movements and the best potential to produce the higher power outputs and running speeds.

There are two possible modes for strength improvement to occur in the body:

- **Hypertrophy** - this simply means to increase the size of a muscle. The force a muscle can produce is directly related to its cross sectional area so any improvement in cross sectional area will result in an increase in force output. Each muscle in your body is composed of muscle fibres which can increase in size - hypertrophy training aims to augment the protein content of these filaments improving their ability to produce force. When performing hypertrophy it must be remembered that all increases in strength are accompanied by increase in weight. This can be advantageous for some players - but any weight gain which results in a decrease in relative strength is likely to be detrimental to player performance. The most effective way to hypertrophy a muscle is to subject it to high volumes of work - this is generally achieved with relatively high reps ranges (8 to 12) and an intensity of between 65 and 75% of the maximum weight you can lift. The work effort at this level must be close to or at failure and recoveries should be strictly adhered to - between 1 to 1.5 minutes.
- **Neural** - you train the body to become more efficient at performing tasks, the coordination between muscle groups improves and the coordination and recruitment of muscle fibres within muscles improves. In this way strength can be improved with minimum weight gain giving gains in both relative and gross strength levels. The heavier the weight you handle in a set the less likely you are to get hypertrophy and the greater impact you will have on your neural system. Weights at or greater than 90% of your maximum will result in the greatest neural gains. Most athletes would only have the ability to handle these intensities for 1 to 3 reps. Recovery for this type of work must be high - from 3 to 5 minutes, without this recovery you will not have sufficient neural recovery and will be unable to maintain lifting intensity. Weights at around 75-85% of your maximum can impact on both neural and hypertrophic strength gains - rep ranges would be from 8 to 4 and recoveries need to be set at around 3 min.

How do I put a strength plan together?

Simply visiting the gym on an adhoc basis will not impact your strength levels as much as putting in place and seeing through a planned programme. When planning your training programme it must be remembered that your goal is to be stronger at the end of that plan and not necessarily stronger after each session. A time proven plan to gain strength effectively is to start with hypertrophy training and slowly cycle your sessions towards neural work. The initial hypertrophy phase will gain strength from size increases and the neural phases will co-ordinate the muscle groups and fibres to maximise their force producing potential. The following tables illustrate a 12 week plan for gaining strength, it illustrates the process of overload and progression - note the lighter weeks which allow adaptation to occur (they involve lifting maintenance loads only) - these weeks are critical in any successful training plan. Please note that the plan includes no **specific** abdominal or core work - these will be dealt with in a later chapter.

Weeks 1 to 4

Table showing exercise choice for first 4 weeks

Monday	Wednesday	Friday
Squat	Clean pull	Squat
Bench press	Romanian deadlift	Bench press
Bent over row	Upright row	Bent over row
Standing press	Hamstring curls	Standing press

Table showing sets and reps for first 4 weeks

Week	Sets	Reps
1	4	12
2	4	10
3	4	10
4	3	12

Table showing intensities for all exercises as a percentage of best lift for the first 4 weeks

Week	Monday	Wednesday	Friday
1	65%	65%	65%
2	70%	70%	65%
3	75%	75%	70%
4	70%	70%	65%

During this 4 week phase all recoveries should be around the 90 second mark, it is essential to adhere strictly to these rest periods to maximise hypertrophy.

If you are a relative newcomer to strength training it is advisable to retest your strength at this point - and use your new results to set your maximums for the next 4 weeks of the schedule.

Weeks 5 to 8

Table showing exercise choice for the second 4 weeks

Monday	Wednesday	Friday
Power clean	Clean pull	Power clean
Squat	Romanian deadlift	Squat
Bench press	Push press	Bench press
Bent row	Hamstring curls	Bent row

Table showing sets and reps for first 4 weeks

Week	Sets	Reps
5	4	5
6	4	5
7	4	5
8	4	5

Table showing intensities for all exercises as a percentage of best lift for the first 4 weeks

Week	Monday	Wednesday	Friday
5	80%	80%	75%
6	82.5%	82.5%	77.5%
7	85%	85%	80%
8	82.5%	82.5%	77.5%

During this 4 week phase all recoveries should be around the 3 minute mark.

Weeks 9 to 12

Table showing exercise choice for the last 4 weeks

Monday	Wednesday	Friday
Power clean	Clean pull	Power clean
Squat	Romanian deadlift	Squat
Bench press	Push press	Bench press
Bent row	Hamstring curls	Bent row

Table showing sets and reps for last 4 weeks

Week	Sets	Reps
9	4	3
10	3	3
11	3	2
12	1	1

Table showing intensities for all exercises as a percentage of best lift for the last 4 weeks

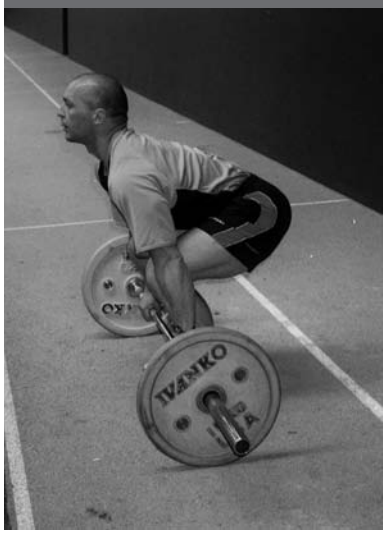
Week	Monday	Wednesday	Friday
9	87.5%	87.5%	82.5%
10	90%	90%	85%
11	92.5%	92.5%	87.5%
12	New max	New max	No train

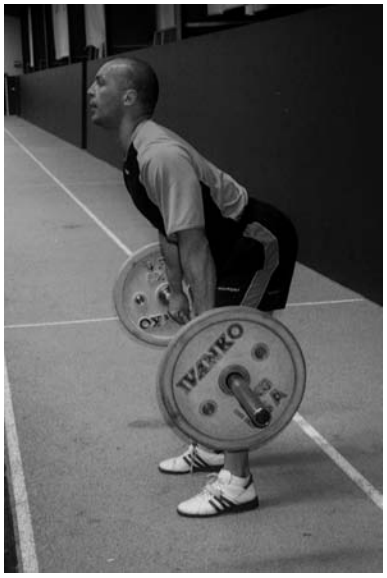
During this 4 week phase all recoveries should be around the 3 to 5 minute mark.

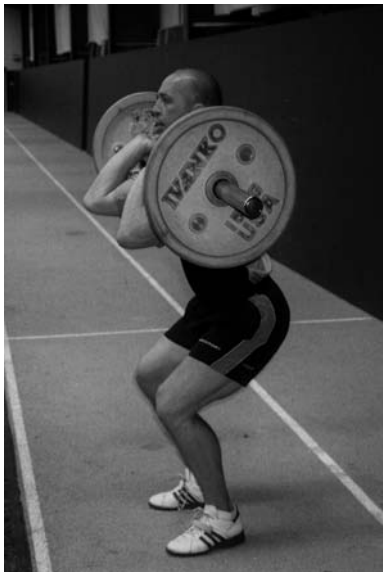
Illustrations of lifting technique

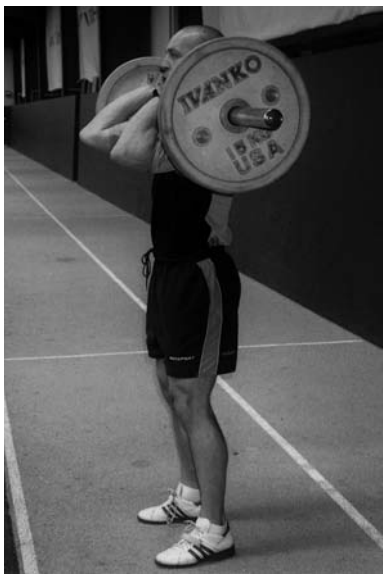
1. Power Clean

Note flat back positions and height of pull



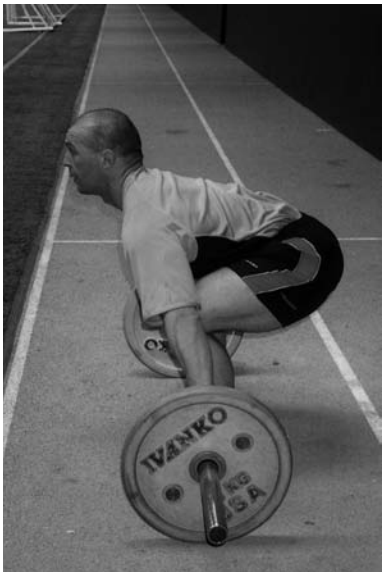


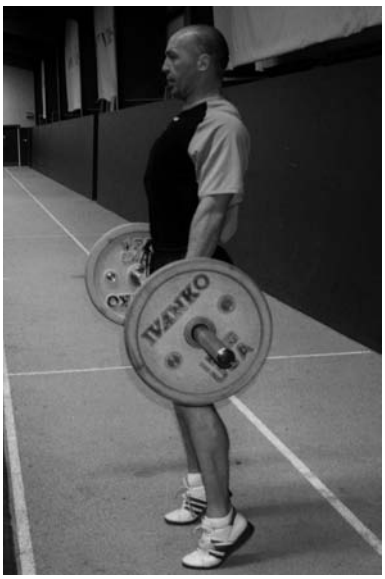




2. Power Snatch

Note high elbows at bottom of squat





Power training

As has already been stated power is a function of strength and speed; it is the ability to exert high force levels rapidly. High force levels are produced via maximum strength training. Power cycles focus upon being able to maintain this high force production but trying to improve the ability of the neural system to recruit fibres for force production quickly. The speed of fibre recruitment is termed The Rate of Force Production, the faster your rate of force production the more power you are able to call upon. Rate of force production can be developed very effectively by using heavy weights (about 90% of your best lift) moved as dynamically as possible for 2 to 3 reps. The rest periods here need to be very high - up to 5 minutes to allow recovery of your nervous system. This type of work is carried out at the end of your strength phase - in order to improve sport specific power further it is appropriate to carry out ballistic and plyometric training following a strength phase. During this period it is important to continue to maintain any strength gains you have made.

Plyometric training

The basis of all plyometric training is that energy stored in dynamically stretched or loaded muscles can be used to enhance movements. The stretching of an elastic band is a good analogy for this loading when the loading is removed a powerful contraction occurs. In our muscles the more dynamic the stretch the greater the potential to produce high power output, but the contraction must occur immediately after the stretch or energy is lost. A good test is to jump and reach on the spot - then take a small bounce and jump and reach again. The increased height achieved in the second rep is due to the energy stored from the dynamic stretch offered by the pre - jump bounce.

Traditionally plyometrics is known as "jump training", because jumping or throwing movements are used to store the energy in stretched muscles. Plyometrics is probably one of the most effective means of improving power output and has been shown to improve speed and especially acceleration.

Plyometric activities for the lower body consist of jumping, hopping and bounding activities. Whilst exercises for the upper body can involve throwing and catching weighted objects such as medicine balls, or some dynamic body resistance exercises (e.g. clap press-ups).

Plyometrics can be very stressful on the body and prerequisites are required before entering a program. A background in strength and general training is essential. Authors have suggested that an athlete should squat 2 x their bodyweight and bench press 1.5 x their bodyweight before beginning a program. This is excessive and would mean some athletes would be forever excluded from plyometric work. It is more pertinent to have a background in weight training where you are used to performing large muscle group exercises dynamically, be injury free and to have a well developed balance and pro-perception system. If a player cannot perform a depth jump from an 18 inch box to the same height as he is able to perform a standing jump he is not ready to commence plyometric work and will gain more from max strength training.

Preparation prior to plyometrics

Before undertaking a plyometric training programme, players must have a sound base of strength. Athletes should look to complete a strength training schedule as in the previous chapter. If an athlete is advanced enough and technically sound enough to begin and complete the strength program they should be ready to commence a plyometric training program.

Putting a program together

When planning a program you need to consider a number of variables;

1. Number of contacts is defined as the number of jumps, bounds or throws you make in a session. You generally look to start at around 50 contacts per session and look to develop this according to complexity and intensity of exercises you undertake.
2. Intensity or complexity of exercise - the more skill involved in performing a movement the more complex it becomes, you would generally aim to begin a cycle with simple movements and move towards more skilful complex varieties. You also have to monitor and plan for intensity - intensity can be thought of as the stress you place upon your body, e.g. a double leg bound is less intense than a single and a standing jump is less stressful than a drop jump from a high box. Your training cycle should commence with low intensity movements and move towards higher intensity work.
3. Frequency - initially 1 session weekly will be ample, at least 72 hours recovery should be planned between all sessions.
4. Recovery - the more intense or complex the exercise the greater the recovery between sets, this can be as high as 5 minutes or as low as 1 minute.

Training muscles to work fast requires quick, explosive movements, with minimal contact with the ground/medicine ball etc. But always remember the aim is explosiveness and speed. You're aiming to get as far/high as possible on every single repetition, there should not be an 80% training session with plyometrics, quality and 100% effort with minimum fatigue levels between sets are the key to power improvement.

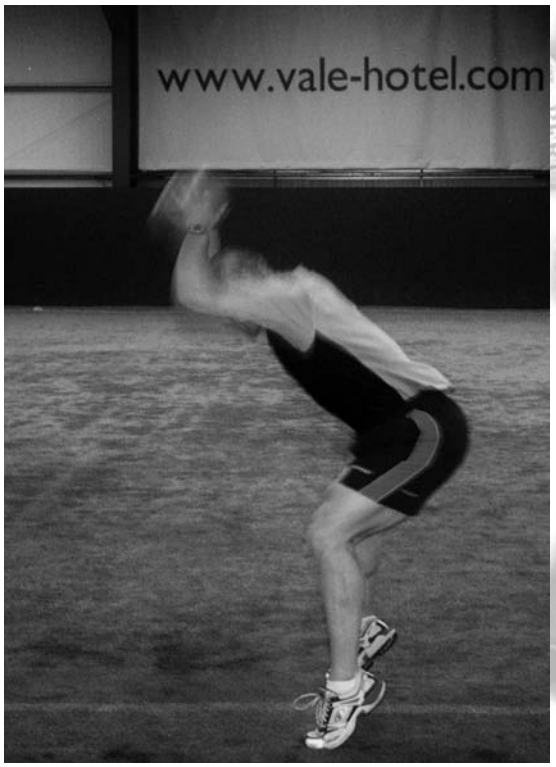
Table showing a developmental continuum for plyometric exercises

Level	Beginner	Intermediate	Advanced
Contacts off season	50-120	100-150	120-160
Contacts pre season	100-150	120-160	160-200
Contacts off season	50	50	50
Intensity	Low to moderate	Moderate to high	Moderate to very high
Recoveries	1 to 2 min	2 to 3 min	3 to 5 min

Table illustrating examples of plyometric exercises of varying intensity

Low intensity	Moderate intensity	High intensity	Very high intensity
Tuck jumps	Two leg bound	Drop jump	Drop jump to single leg bounds
Jumps to a box	Alternate leg bound	Standing triple jump	
Squat jumps	Two leg lateral hop	Single leg hops	Plyometric to sprint activity
Wheel barrow walk	Med ball back toss	Uphill bounds	
Standing long jump	Lunge jumps	Drop clap press up	

Overhead throw with medicine ball



Complex training

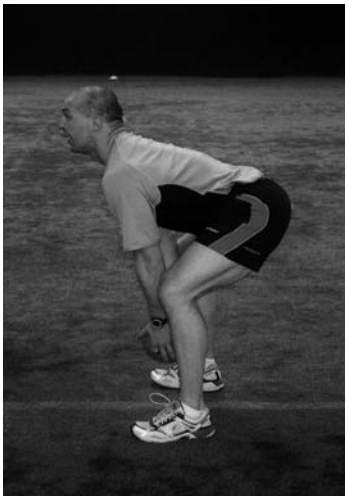
Complex training is a method where weight training exercise and sport specific methods are combined in pairs. It can be a very effective method of producing power gains.

During the weight training sets the exercise intensity needs to be high (80-90% 1RM) and dynamic, recovery period between the weights exercise and the plyometric complex should be 1 to 2 min. After each complex you require up to 3 min to ensure maximum intensity can be produced during the next set of weight training exercises. Complex training is very demanding on the body and 4 - 6 weeks of work is the maximum timeframe you should consider for a cycle. This intensity of work means volume of exercises is generally lower than normal and 3 to 4 pairs of exercises per session are ample.

Table showing example of complex training session suitable for rugby

Weights exercise	Sets and reps	Complex exercise	Sets and reps
Power clean	3 x 4 @85%	Hurdle jumps	3 x 5
Bench press	3 x 4 @85%	Med ball chest throw	3 x 5
Parallel squat	3 x 2 @90%	10m sprint	3 x 2
Stiff leg deadlift	3 x 4 @85%	Pike jump	3 x 5

Medicine Ball Toss for Height



Speed

Speed has more or less become a prerequisite for playing the game of rugby and although some players may display greater speeds than others on the pitch, it is almost certain that every player will be working on their speed off the pitch.

Speed and agility training involves improving the ability to accelerate, improving a player's top speed and also their ability to manage their body weight when changing direction.

Speed is a combination of frequency of stride and stride length.

The first port of call when attempting to improve speed should be to look at running form - or technique. Improving this can produce dramatic gains in speed.

Running form

Here are a series of simple points that describe sprinting technique.

The leg cycle

The legs individually go through a cycle of three phases every stride. The first is the support phase, whereby the purpose of the leg is to simply support the weight of the body. As the body passes over the foot, the leg moves into the drive phase which involves extending the ankle, knee and hips and drives the body upwards and forwards. As the leg finishes the drive phase, it moves into the recovery phase. This entails the ankle being tucked up behind the hamstring and the knee being brought forwards and upwards, as the knee comes to the end of its motion, the lower leg is extended ready to move into the support phase once again. The height at which the knee is raised and the closeness of the ankle to the hamstring depends upon the velocity achieved. During acceleration the knee raise and foot tuck are not as great as when running at full velocity. This is because you are concerned with taking fast short strides, rather than the longer cyclic movements required to produce top end speed.

Arm action

The arms should remain locked at 90°, with the shoulders relaxed to allow a fluid motion. The arm action opposes that of the legs, so that as one leg moves forward, so does the opposite arm, and as a leg moves backwards, so does the opposite arm (right arm with left leg and left arm with right leg). The extremes of motion of the arms are best measured using the fists, which when sprinting should be relaxed, not clenched or fully splayed. The most forward position should be when the fist is level with the jaw. As it is the rear drive of the arm which assists the forward leg drive of the opposite leg, it could be argued that it is the most important part of the arm action. With this part of the action, the fist should be moving backwards until it is at least level with the hips. For the entire cycle the elbow bend should remain at 90°.

Drills to improve running form should be carried out over 10 to 30m and are often suitable warm-ups to speed training sessions, 5 drills for 3 reps each is an ample workload/warm-up.

Examples of drills:

Skips	Butt kicks
A drills	B drills
4 x 4's	2 x 2's
Straight leg runs	Arm swings

Speed development involves a variety of methods, many of which are covered in other sections of this manual and involve weight training, core development and plyometrics. Sport loading, over speed and speed endurance are other aspects that will be covered below.

Sport loading

This involves sprinting whilst being resisted in some manner. This can be achieved in a variety of ways. These include using harnesses, weighted jackets, parachutes and running uphill. It should be noted, that although these exercises make the specific running muscles stronger, they don't necessarily make them faster. The resistance you place on a muscle causes it to work harder and may make it recruit more muscle fibres, this increase in power output, through progressive training, will eventually be transferred to your un-resisted running.

Care must be taken to ensure the correct level of resistance is applied. Light to moderate resistance achieves greater gains. When applying resistance it is important not to apply so much that it negatively affects running style. This type of activity is very demanding and the distances covered, repetitions, and rest periods must initially be conservative and progressively increased.

Distances should be a minimum of 5m and maximum of 30m as resistance sprinting is much more intense than similar forms of speed training. Obviously the type of drill, level of fitness and training experience, will influence the distances, rest periods and volume of weekly sessions. Generally speaking:

- Distances 5 - 30m
- Repetition 4 to 8
- Recovery 1 to 3min

Rest periods should be long enough to ensure near full recovery between repetitions if speed development is to be maximised. Resistance sprinting is also excellent for developing a stable midsection and promoting a forward lean torso position. This running position is crucial for rugby players as it allows for much greater balance and stability. This enhances stopping, rapid direction change, and game specific skills and reactions.

Over-speed

This involves a neurological adaptation to training. This means that you adapt the muscles you have to make them move more quickly. This may be done either by being pulled along using an elastic harness, whereby the body must get used to moving more quickly than it has previously, or achieved by running down gentle slopes. It is vitally important, that with both of these methods, correct form and posture is maintained otherwise it is harder to transfer the benefits to a real situation.

As with resistance running it is important that the work is carried out under fatigue free conditions. This means that a player should not enter the session with any residual fatigue and sessions require high recovery periods between runs of 3 to 5 minutes.

The number of runs carried out during a session need only be 9 max (as 3 sets of 3), and reaching this number of runs should occur as a progression over 5 to 6 weeks.

Speed endurance

Once a good speed base has been built up, it is important to develop this so that a high speed can be maintained over longer distances. Speed endurance is best done at the end of a session or as a separate session altogether. Whereas pure speed sessions may not involve going over distances of more than 40 - 50m, speed endurance sessions may involve sprinting over distances of 100 - 200m. Sessions should be designed firstly to maintain high quality work; this may mean shorter distances with longer rest periods. As the players develop, the distances should be increased and then the rest periods reduced.

Agility

Agility involves being able to move over short distances quickly, change direction well and training the body to be able to manage its own weight when changing direction.

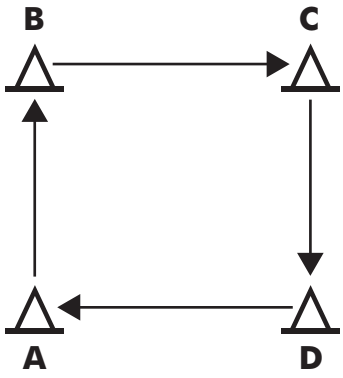
Agility can be developed by trying to replicate the movements that occur on a pitch. This can be achieved by using equipment such as speed ladders, cones, mini hurdles and poles. It should always be remembered that being able to decelerate is as an important part of agility training as being able to accelerate.

Agility drills do not always reflect the reactive and decision making qualities that are required in a game situation. This means working in pairs is a useful exercise. Drills which involve two players may require one to move laterally and the other to stand opposite, react to his partner and mirror their actions. Working for 4 - 6 periods of 6 ~ 10 seconds followed by 30 ~ 45 seconds rest is sufficient time to get a quality, high intensity workout from the players.

It is imperative that when performing speed and agility sessions, good form and posture is maintained.

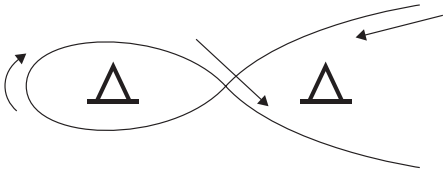
Examples of agility drills are:

Agility square



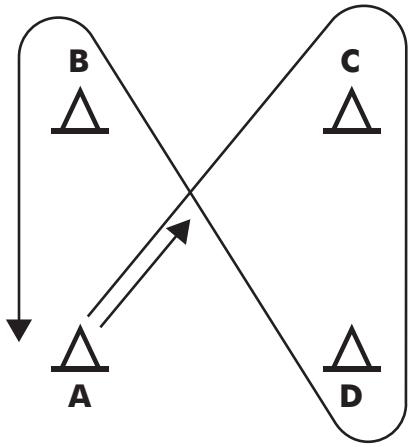
Set up 4 cones 5m apart
Sprint side AB
Move laterally BC
Backwards CD
Stay low throughout
Use arms to drive and accelerate

Figure of eight runs



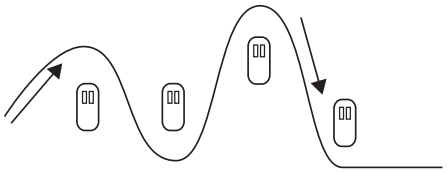
Set up 2 cones 5-10m apart
Sprint around in a figure of eight shape
Again keep a low centre of gravity
Ensure arm drive is used to accelerate

X cone run



Cones are set up as per agility square
Sprint AC
Run backwards CD
Sprint DB
Turn around cone B
Sprint through to cone A

Bag dodge



Place bags 3-10m apart
Sprint hard through bags
Practice planting and driving
off outside foot when turning

Ball dodge

Working in groups of 3 to 4 play games where individuals take it in turn to dodge footballs, tennis balls thrown at them by the other players.

With all agility work it is important to remain fresh - reps should last no more than 7-10 secs and recovery must remain adequate to facilitate quality work. The limits of agility drills are endless and are limited only by your imagination.

Core stability

The lower abdomen, hip and glute area are vital in power production and power transfer in athletic movements, they are areas which are also very prone to injury problems. Having a strong, stable core will make you a better athlete it can help improve all aspects of your game from sprinting to scrummaging.

Generally when people work their core they tend to think of the superficial muscle called the rectus abdominus which form the 6 pack, they attempt to build a strong core with exercises such as sit ups and leg raises. A strong core requires much more than this and involves many sets of muscles located and attaching in our abdomen and hips. The deeper muscles that are closer to the centre of the body tend to act as stabilisers, whereas the more superficial surface muscles act as the large force producing, mobilising muscles. It is vitally important that all areas of the core have sufficient attention paid to them.

A term often used in core training is neutral spine position, this position is the most suitable and efficient for athletic movements and limits shear forces on the spine. A neutral spine position is attained when muscle activation minimises the curvature present in the spine. This position is very effective for force production, power transfer and minimising injury risks.

Core stability can be maintained and developed with traditional exercises such as squats, deadlifts and plyometric exercises but this development and training can only occur when an athlete is able to use his core muscles correctly and also realise when and how they are using them - this involves attaining and maintaining a neutral spine position and utilising your hip, buttock and groin muscles correctly commonly termed switching on or activating your core. There is currently a vast array of equipment available to teach and aid athletes in activating and developing their core, these include medicine balls, Swiss balls, core boards, wobble boards and foam rolls. This section intends to outline the basics of core conditioning and give a basis for developing the control and strength of your core.

Having a stable core is dependant upon the following:

- Having a skeletal system and attached ligaments which are healthy and able to hold the correct positions or postures.
- The core muscles should be able to develop suitable forces.
- You should be able to control these muscles with your nervous system to activate the muscles - which in turn affect your posture. The long term goal of your core training should be to make this activation an unconscious, habitual occurrence.

As with other training schedules you must know where you start and at what level you can join a training program - below is a 5 level system which covers all points of development from novice to expert.

LEVEL	DESCRIPTION	SUGGESTED EXERCISES	DIAGRAM
LEVEL 1	Master awareness and contraction of core muscles	Lie flat on your back, bend your knees and keep your feet flat on the floor. Try to tilt your pelvis up to the ceiling so that as much of your back is on the floor (no gaps in your lower back). Hold this for 10 seconds, whilst maintaining normal breathing. If control is lost, start again.	
LEVEL 2	Static holds and slow movements in stable environments	Set your core muscles, then perform a two legged squat, progress this to a single legged squat. Position yourself face down, supporting yourself on your toes and elbows; contract your core for 10 second intervals. If control of the core muscles is lost at any time, reset yourself before continuing.	
LEVEL 3	(a) Static holds in unstable environments and (b) dynamic movements in stable environments	(a) With a Swiss ball under your shoulder blades, lie with your feet out and knees at 90°. Maintain a position with your feet shoulder width apart, and hips high so that there is a straight line between your knees and shoulders. Progress this to kneeling on a Swiss ball, making sure your core is active and hips are forward. (b) Unsupported, seated shoulder press. Maintain a neutral spine position throughout the entire range of motion and exercise set. Progress this to single leg cable punches, stand on one leg, and push forward without allowing your shoulders or hips to rotate.	
LEVEL 4	Dynamic movements in an unstable environment.	Lying on a Swiss ball as in level three, raise one leg off the floor and perform, 10 leg extensions, return your foot to the floor and repeat with the other leg. Supporting yourself in a press up position with your feet on a Swiss ball, rotate your hips so that your toes are pointing crossways, bend your knees so that the Swiss ball rolls towards your upper body, roll the ball back out and rotate your hips the other way then repeat.	
LEVEL 5	Resisted, dynamic movements in an unstable environment	These exercises are more sport specific and may involve passing rugby balls or medicine balls whilst kneeling on a Swiss ball.	

Progression to a higher level should not be completed until the current level has been mastered. Even then, previous levels should be maintained, for example, someone who is able to perform level 4 exercises should also maintain exercises from levels 1, 2 and 3.

As a guide, a player should only move on when they can competently perform 3 sets of 10 repetitions on the exercises in that level. This may mean that they move through the flowing set of progressions:

2 x 8 repetitions;
2 x 10 reps;
3 x 6 reps;
3 x 8 reps;
3 x 10 reps

It is important that this stability is not left in core sessions but is carried through into all forms of training, only by maintaining 'good form' and correct posture at every opportunity will core stability become a natural involuntary reflex.

Recovery

Recovery refers to your body's ability to adapt to the workloads placed upon during training and competitive situations. Not recovering or adapting is detrimental to your performance and sometimes your health, it can lead to a condition known as overtraining syndrome, commonly termed burn out. If you are able to accelerate your rate of recovery after competition and training, your training will be more effective and more likely to produce the required gains. Recovery training can be thought of as a method of accelerating the adaptation stage.

The stresses produced during training and competition can vary greatly and this will affect the time taken to recover as well as the type of recovery work you would undertake in order to improve your rate of adaptation. It is important to realise that the psychological stress imposed during competition/training is as important as the physical stress that occurs.

Fatigue has been divided into four main types:

- **Nutritional** - this type of fatigue can be explained by measurable factors such as dehydration, lack of fuel in the muscle or build up of waste products such as lactate.
- **Physiological** - a build up of waste products such as lactate causing localised fatigue at the muscle cell.
- **Neurological** - the peripheral nervous system (i.e. the nerves responsible for movement and control of your muscles etc) become fatigued from high intensity work.
- **Psychological** - the central nervous system (i.e. your brain and spinal cord) becomes fatigued from competition and training.

Each type of training method employed to improve your performance will supply your body with a unique set of stimuli and therefore a unique set of stressors which you will need to recover from.

- **Endurance training** - both aerobic and anaerobic is likely to produce nutritional and metabolic fatigue, the higher the intensity of the work the greater the likelihood of neurological fatigue.
- **Weight training** - the type of work performed in the gym will impact the fatigue produced, hypertrophy work (high volumes, small rest periods) will impact both nutritionally and physiologically, as the quality of the work increases to strength and power (lower volumes far more intensity) the main stressor is neurological followed by physiological and nutritional.
- **Speed work** - the low volume and high intensity of speed training means the main impact is neurological, with longer distances there will also be physiological and nutritional aspects to consider.
- **Games** - will impact all forms of recovery and are likely to have the highest psychological fatigue carryover, especially in important competitions or at times when a team is fighting for a league position or to avoid relegation.

If you are able to marry the recovery work you perform to the stressors your training produces you will adapt at a faster rate and all aspects of your performance will improve. The following are illustrations of effective recovery strategies for different types of fatigue:

- **Nutritional fatigue** - replenish fuel and fluid supplies as quickly as you can at session end. See nutrition chapter.
- **Physiological fatigue** - active recovery work (good cool downs, stretching, easy pool session etc), hydrotherapy (Jacuzzis and 4 sets of hot (1min) and cold (30secs) contrast showers or baths), sports massage.
- **Neurological recovery** - active recovery work, massage, hydrotherapy and passive rest (relaxation time and quality sleep)
- **Psychological recovery** - motivational work, visualisation, meditation, massage and passive rest.

The Healthy Training Diet

'Regardless of sport type, diets should be sufficient in calories, high in carbohydrate, moderate in protein, low in fat, with plenty of fluids and balanced to provide an adequate supply of vitamins and minerals'

Whether you are training on a recreational or a professional level, you will still need a healthy well balanced diet to get the maximum benefit from your training or conditioning programme. The general approach quoted above is one that largely holds true today and has been adopted in many sports including rugby. The significant difference today is that as a result of increases in knowledge of rugby from advances in science and technology, we are able to apply modifications to certain areas to enhance performance and reap additional health gains. This chapter examines the basics of sports nutrition and also looks at specific topics often asked about in rugby such as 'bulking up', fat loss and supplementation.

Carbohydrates

Are the most important energy source for working muscle? Avoidance of these will lead to chronic fatigue, a low intake of B vitamins for a healthy nervous system and efficient energy production, iron, calcium vitamin C and others.

Q: 'I have been told that I should avoid carbohydrates as they will make me put on weight'

A: This is a myth. Carbohydrates do bind to water in the body so in the initial stages of re balancing your diet (i.e. increasing carbohydrates), then you might appear to put on weight, but this will be water retention and not fat gain. This effect will soon disappear and you will soon see and feel the benefits on your weight and body shape from being able to exercise for longer and harder.

Q: 'I found that carbohydrates make me very bloated'

A: This does happen, mainly because carbohydrate foods contain fibre which will fill you up very quickly. This makes carbohydrates essential for weight loss as they are naturally low in fat and naturally prevent you from over eating them. If you find they bloat you too much then try increasing them more slowly to allow your body to get used to them.

Sources of Carbohydrate

There are two sources, a *starchy* variety which should be included at main meals, and the *Simple* 'sugary' varieties which should only be used as a snack in between your meals.

Starchy Carbohydrates

These are the best form of carbohydrate as they contain fibre, and a variety of vitamins and minerals as well as carbohydrate for energy.

- Breakfast cereals
- Bread (inc. tea cakes, crumpets, pitta)
- Pasta and noodles
- Rice, cous cous
- Potatoes
- Crispbreads, oatcakes, rice cakes
- Deep pan pizza's
- Beans
- Peas and lentils

The best types of starchy carbohydrate are the wholegrain, wholemeal or granary varieties. Unfortunately they are very filling so where carbohydrate needs are high it may be necessary to use more basic white or brown varieties to ensure these needs can be met.

For a better understanding of what carbohydrate to use and when, use the glycaemic index.

Any changes to your diet should be done gradually around your training and not before any event or competition.

Simple Carbohydrates

As the name would suggest, these only provide sugar to boost carbohydrate levels. They should only be used where carbohydrate needs cannot be met by starchy carbohydrates alone, or where a lower fat/healthier snack is required in between meals.

- Sports drinks
- Confectionery
- Low fat muffins
- Cereal or breakfast bar, Crackers
- Fruit cake
- Welsh cake/low fat scone
- Fig rolls

So while it is still the case that carbohydrates should form the basis of your training diet, manipulating the quality of these foods at specific times can help improve your recovery and potentially your performance.

Ways to increase carbohydrate in your diet

- Change your daily routine to eat smaller carbohydrate based meals more often.
- Consider using an isotonic drink during the day.
- Incorporate simple carbohydrate snacks in between your meals making sure you have these to hand when you need them.
- Try fortifying your food, for example;
  i) use thicker slices of bread
  ii) try triple decker sandwiches
  iii) add pasta to soup
  iv) use milk smoothies, or a meal replacement drink
  v) add jam/marmalade/honey to toast or other bread based foods or drinks
  vi) Add dried fruit on to cereals

Q; What is the best training diet?

Low carbohydrate diets?

Zone, Protein power, Atkins, South Beach (phase 1) are all high protein diets which have been re-branded as low carbohydrate diets. Although there is evidence that these diets are successful in achieving some short term weight loss, these results are more likely achieved from individuals being on a restricted calorie regime than any other reason. All the evidence to date only shows short term changes and there is some difference in the effectiveness between men and women. These diets are marketed at the general population. **Due to the restriction of carbohydrates they are not suitable for athletes.**

A; No, the best training diet will be one which focuses on doing the basics well and consistently well. Namely;

i) Ensuring good hydration
ii) Maintaining a good meal routine based on good organisation
iii) Making your diet as varied as possible with good quality foods
iv) Eating a diet based around carbohydrate
v) Ensuring good recovery after each session (including eating at the right times, sleep or active recovery)

Glycaemic Index

Different foods affect blood sugar levels in different ways. Some cause a high, quick rise in blood sugars whilst others produce a slow gentle rise. In addition, blood sugar response to a particular food will differ between individuals.

The only foods to create rises in blood sugars are **carbohydrates**.

The **glycaemic index** is a list of carbohydrate foods that measure the effect that a carbohydrate containing food will have on your blood sugars. This information is important when assessing which carbohydrates to have at certain times of the day. Eating the wrong types of carbohydrates at any stage of your daily diet will restrict the effectiveness of your training programme, especially if you are trying to lean up and reduce your total body fat compositions.

When trying to control blood sugars, the aim should be to eat carbohydrate foods which cause a quick rise in blood sugars in preparation or recovery from training. Carbohydrates that cause a slow rise in blood sugars should then be used in your normal eating pattern after training has been completed. **Controlling your blood sugars at different times of the day will help to maximise your training programme**.

This Fact sheet will help you to understand which are the best types of carbohydrate to choose when planning your meals and snacks. It will also suggest the best times to have the different types of carbohydrate.

Q: If I change my carbohydrates to those advised will this mean I will lose body fat?

A: It will significantly help, but whilst the **quality** of carbohydrates (i.e. the glycaemic index) is important, success will depend on the quantity in relation to the rest of other food groups you include in your diet (protein and fat).

High Glycaemic Foods (GI)

These are foods which are absorbed quickly into the blood stream, and cause a sharp, high rise in blood sugars. These foods should only be used 45-60 minutes prior to training, or in combination with a snack meal after training to help recovery until your normal eating pattern can be resumed.

These foods should be avoided during periods of injury when activity is limited. They should also be reduced on rest days, unless advised otherwise by the sports dietitian.

Low GI Foods

are the opposite of high GI Foods and should be used at breakfast times, and evening meals. They should also form the bulk of your diet during periods of reduced activity. Low GI foods also help you feel fuller for longer. This is useful if you are trying to reduce total body weight.

Intermediate GI Foods

are useful because they give the benefits of both High and Low GI foods. These are good to use at breakfast and evening meal during periods of intense training.

Summary

Carbohydrates

Carbohydrates are the key to success for any training or performance goal. A lack of carbohydrates will cause fatigue and over a long period of time nutritional deficiencies which could influence health. For this reason any low carbohydrate regime should be avoided. Rather than focusing on just quantity, look at the quality and timing of your carbohydrate intake which is equally as important and should be considered before any restriction in just carbohydrate. It is also important to remember that the higher fibre content of some lower glycaemic foods may fill you up quicker and therefore lead to a reduction in total carbohydrate intake. So attention to recovery is essential!

How different foods affect blood sugar levels (Glycaemic Index)

	Low GI (Main meals)	Intermediate GI (Main meals)	High GI (Recovery)
Drinks	Sugar Free varieties	Sports Drinks, Fanta, Cola	Lucozade, Glucose drinks
Cereals	All Bran, Muesli, Porridge, Special K, Sultana Bran, Fruit & Fibre - type, Oat & Wheat Flakes	Shreddies, Sustain, Grapenuts, Cheerios	Cornflakes, Cocopops, Any sugar or honey coated cereals, Weetabix, Shredded Wheat
Bread, biscuit & Cake	Heavy grain bread e.g. Granary/multigrain, Pitta Bread, Rye bread, Chapatis, Fruit loaf, Sponge cake* Banana cake*	Fibre enriched white Bread, Ryvita, Oat meal biscuits, Shortbread* Muesli bar*/flapjack* Croissant, Muffin, Digestive biscuits, Crackers	Brown, Wholemeal/white, French stick, Bagels, Crumpets, Water biscuits, Puffed crispbreads, Rice cakes
Potatoes Rice & Pasta	Yam, Sweet potatoes, Basmati Rice, Noodles, Most types of pasta	New potatoes, Boiled potatoes, Macaroni	Instant potato, Mashed potato, Jacket potatoes, Chips*, Instant rice, Brown/white rice
Fruit & Vegetables	Apple, dried apricots, banana, cherries, cantaloupe melon, grapefruit, grapes, kiwi, mango, orange, peach, pear, plum, fruit cocktail, apple juice, orange juice, grapefruit juice, carrots, peas, sweetcorn	Apricots (canned), Pineapple, Papaya, Squash, Sultanas & raisins	Parsnips, Pumpkin, Swede, Broad beans, Watermelon
Legumes/grains	Baked beans, butterbeans, black eyed beans, lentils, chick peas, soya beans	Cous cous	Tapioca
Snacks	Most chocolate*, Popcorn, Crisps*, Peanuts*/nuts*		Confectionery e.g. jelly babies, cola bottles, Corn chips, Jaffa cakes, Turkish delight etc
Dairy	Low fat ice cream, milk, yoghurt	Full fat ice cream*	

* Foods containing relatively high amounts of fat - keep these to a minimum

Protein

Is essential in any training diet to repair tissue damage that occurs during exercise. It will also maintain lean muscle tissue, which is especially important where weight loss or increasing leanness are the primary goals. Protein foods are good sources essential for bone health and energy production, muscle growth and repair of a number of vitamins and minerals.

Requirements for protein will increase with exercise, but these increased needs are usually met by increasing foods generally in your diet. Where possible try to choose low fat or a lean version of good protein containing foods such as dairy products and meat.

Sources of Protein:

Animal

- Beef, lamb, pork, chicken
- Liver
- Grilled fish
- Fish fingers
- Meat products (burgers, sausages)
- Salmon, tuna
- Eggs
- Cheese (including soft cheese)
- Milk
- Yogurt

Plant

- Nuts
- Seeds (e.g. sunflower)
- Baked beans
- Kidney beans/split peas
- Lentils
- Peanut butter
- Bread
- Pasta, rice, cereals
- Leafy vegetables

Q; Are you having enough protein?

A; Generally your protein needs will be met by any non restricted diet. However those at risk of having insufficient protein include fussy eaters and dieters. This may also be the case during high intensity periods of aerobic training where players have swapped protein for extra carbohydrate.

A high carbohydrate, protein rich diet meeting all nutrient requirements can easily be achieved with sensible food selection. Not eating enough for a long time may cause muscle loss, slow recovery and serious health problems if continued due to these foods containing essential vitamins and mineral such as calcium and iron.

Q: Does exercise increase my protein needs?

A; Exercise will increase your need for everything. In general those involved in strength training and high intensity activities (weight training, sprinting, and rugby) will need more protein than those doing aerobic training (distance running, swimming).

Additionally, if you are in the first few weeks of starting back into a training programme you will also require more protein than usual.

Q: Do I need a High Protein Diet?

Protein needs are based on body weight, and also related specifically to the type of training and sport you are doing. For recreational athletes, simply increasing your general food intake should be sufficient to meet additional protein needs. However, in the case of large framed athletes (i.e. greater than 100kg), particular attention to a well structured diet is required to ensure additional protein requirements are met.

Whilst protein is important it can also be detrimental to your training or performance. Filling up on protein foods and drinks will leave less space for more useful carbohydrates, making you lethargic. As a result of this the excess protein will be used as an energy source.

Any increase in protein intake should be accompanied by an increase in fluid intake to wash away the toxic bi-products of protein metabolism.

Dietary tips to increase protein:

- Generally increase both plant and animal containing foods in your diet
- Add low fat cheese to sauces, soups, mashed potato, casseroles or melt onto vegetables or pasta etc.
- Add peas, beans and lentils to soups and casseroles.
- Add dry milk powder to mashed potatoes, white sauces, soups, gravies, puddings and scrambled eggs.

When do I need Protein?

Protein should be included at each meal, but also in combination with carbohydrate snacks that you have in between your meals. There are several reasons for this. Firstly, not having too much protein in one meal will leave more space for healthier carbohydrate. Secondly by spreading your protein intake over the course of the day in small amounts it is more likely that you will be able to eat a greater quantity. Finally, evidence shows that a combination of protein and carbohydrate in recovery is the ideal mix to replenish glycogen stores and repair muscle tissue.

Simple High Energy Drink

250ml low fat milk
3 tablespoons skimmed milk powder
1 scoop low fat ice cream

Blend all ingredients together, add flavour or fresh/tinned fruit if desired.

Analysis: 340 Calories, 26g protein, 7g fat, 47g carbohydrate

Summary

- Exercise does increase protein needs.
- Additional protein needs can usually be met by food
- Extremely high protein intakes do not help increase strength or muscle mass
- Protein powders and liquid meal replacements may be included when attempting to increase weight, prevent unwanted weight loss during heavy training. Try to use one which has other useful ingredients such as carbohydrates, vitamins, minerals and where possible fish oils
- Protein should be included in small amounts at all main meals and snacks especially with carbohydrate after exercise

Fat

Whilst excessive fat is not desirable a small amount of fat is essential for health. Avoiding fat completely or adopting very low fat diets will make your diet low on essential fatty acids and fat soluble vitamins (A,D,E). As a result your training diet should be low in total fat, and of the fat remaining in your diet try to make the types which are beneficial to your health and performance i.e. not saturated fat.

Q: What type is best?

A; Fats are commonly split into 3 categories. ***Saturated fats*** are mostly of animal origin (Meat, butter, lard, dairy products, biscuits and processed snacks). These are the worst types of fats as they are considered the culprit fat in heart disease. For this reason saturated fats intake should be limited or preferably avoided as they provide no positive benefit.

Polyunsaturated fats are liquid oils usually found in plant sources (seed and nut oils, margarine and other products made from these oils) and oily fish. These are better than saturated fats as they help lower total cholesterol and so reduce heart disease risk.

Monounsaturated Fats

These are liquid at room temperature and sources include olive oil, rapeseed oils, nut oils, nuts and seeds. Evidence has shown that these types of fats have the greatest health benefits as they not only help to reduce total cholesterol but also reduce the levels of more harmful cholesterol in the blood with greater effect.

Essential fatty acids

These are a sub group of polyunsaturates which are essential for health and cannot be made by the body so have to be provided by the diet. There are two main essential fatty acids - Linoleic acid (an omega-6 fatty acid found in vegetable oils, margarines), and linolenic acid (an omega 3 fatty acid found in oily fish, walnuts, dark green leafy vegetables).

Pack in the '3's

We need both omega 6 and omega 3 fatty acids, but our diet is usually more deficient in omega 3.

- Have fish 2-3 times per week.
- Try sardines or mackerel on toast for breakfast
- Fresh tuna as an evening meal with a spinach style salsa
- Add crushed seeds into soups or on salads (Linseeds, Pumpkin seeds or sesame seeds)
- Use sweet potato at some main meals - *good source of low glycaemic carbohydrate!*

Can Omega 3 fatty acids help athletic performance?

No single dietary factor will do this unless the other building blocks (hydration, a balanced carbohydrate based training diet, recovery etc) are in place.

Of the studies done on omega 3's in this area, results have been most specific to aerobic metabolism, namely;

- Enhanced oxygen delivery
- Increased energy levels
- Improved release of growth hormone in response to sleep and exercise during specific training periods
- Reduced inflammation caused by training

So, they benefit your performance and they are healthy; ***Get them in!***

Tips to reduce the fat in your diet

- Switch from full cream milk to skimmed or semi skimmed varieties
- Avoid deep fried foods
- Use low fat spread or peanut butter rather than butter or margarine
- Use jacket potatoes instead of chips
- Use chicken, fish or lean red meats
- Grill bake or stir fry rather than frying
- Remove skin from chicken or turkey
- Reduce cakes, biscuits, crisps and pastry dishes in diet. Use crackers, rice cakes, fruit or fruit bars instead
- Limit eating out at fast food or takeaway restaurants

Summary

Low fat is good for health but alone this is not necessarily good enough for your performance. Cutting fat will just lower the amount of total calories in your diet which could ultimately compromise your weight, especially during hard training periods. Take active steps to reduce your total fat intake but make sure that you maintain the good essential fats in your diet.

Fruit and Vegetables

Vitamins are vital for energy production and ensure healthy cell and muscle tissue. Regular exercise increases the requirements for most vitamins and minerals, however these can be mostly met by the increased food intake that goes with this additional training. However, vitamin and mineral intakes will vary between individuals based on age, size, injury or illness history and individual body chemistry and of course the quality of a diet.

For this reason a good selection of fruits and vegetables are essential in your daily diet to help this. These may be either raw, or included as part of dishes such as shepherd's pie, chilli, or even salad as part of sandwiches. If you don't like eating vegetables, a modern alternative of getting the 'goodies' from vegetables without eating them is to juice fresh vegetables in a juicing machine. Whist these machines are relatively inexpensive, you can purchase shop varieties e.g. V8.

Leafy green vegetables are an excellent source of iron, so where your diet may be limited in meat ensure you try to include these type of vegetables wherever possible. Where cost or waste is an issue, frozen or tinned vegetables are just as nutritious.

Should I take a vitamin supplement?

Supplementation is not as simple as just taking an individual nutrient because 'you don't eat much of a specific food'. Vitamins often work best in combinations, indeed small doses of individual nutrients taken as supplements have to be questioned. A simple multivitamin or mineral complex may benefit certain groups of people.

Who could benefit?

i) Anyone on a restricted diet with a heavy training schedule. This will include vegan's or very strict vegetarians who eat no animal products and who may struggle to meet the calcium, iron, and vitamin B12 requirements
ii) Anyone with a poor lifestyle and erratic eating patterns
iii) Anyone who for medically proven reasons has to avoid certain major food groups (e.g. dairy products or wheat products)
iv) Extended trips abroad where diet is restricted through poor food choice
v) Extended periods of illness which has resulted in a generally poor intake of food - especially fruits and vegetables

Top tips to keep the vitamins in!

i) Avoid soft, bruised or poor quality produce
ii) Don't prepare food too far in advance as vitamins are lost if left and kept in a cup or left to stand
iii) Steam or stir fry vegetables to get the most out of them.
iv) Make sure the water is fast boiling before you add the vegetables.
v) Cook the vegetables for as little time as possible until they are tender and crisp

Summary

Go for 5 portions of fruit or vegetables per day as a minimum. While there are ideal ways to prepare vegetables and store fruit - eating something is better than nothing so don't be too fussy. Go for as many different coloured fruits and vegetables as possible - don't be afraid to experiment.

Recovery

During most sports your body will steadily burn a fuel mixture of carbohydrate and fat. If your sport or training is less than 60 minutes then you will perform well without having to replace those fuels. However, unlike nutrients you will have to constantly replace fluid during activity to prevent the problems associated with dehydration.

If your training takes longer than one hour then you may benefit from consuming some carbohydrates in addition to fluids. How much will depend on:

- How well you have eaten before training
- The intensity of the session
- The temperature
- The duration

Less than 90 minutes

In most team sports, a carbohydrate (isotonic) drink should be sufficient to delay any fatigue. It should not be necessary to eat any solid food before the session if training lasts less than 90 minutes as eating well prior to the start of the session will have much more of an effect on your performance. Exceptions to this may be if an athlete has a medical condition such as diabetes where they may need additional food to control blood sugar levels.

When training or playing in extremely hot conditions or after travelling from a cold to a hot and humid climate, it may also be necessary to consider electrolytes (Sodium, potassium, chloride) as part of a recovery strategy. This could include adding extra salt into food for the few days immediately before or after that session or event.

Alternatively you could use a more specific electrolyte replacement drink. Such drinks seldom supply carbohydrate in them so have to be taken with carbohydrate fluids or foods to ensure an adequate recovery.

Q: Why should I eat after sport?

After you have finished training, your body will have used glycogen, fluids, some protein and a small amount of body fat.

Fluids and carbohydrates are the most important to replace soon after training. Straight after training, your body is most receptive to storing any carbohydrate that you eat in the muscles in preparation for the next training session. This effect lasts for about 2 hours - but it is most effective in the first 30 minutes after you finish.

It is now that protein has an important effect on recovery, however, usually enough protein can be gained from carbohydrate foods (breads, pasta, rices etc)

Q; What should you eat after sport?

These foods should mirror the content of your pre exercise meal.

- High carbohydrate,
- Moderate in protein,
- Low in fat
- Include plenty of fluids

Q: 'Will eating a high carbohydrate meal after 8pm increase my body fat'

A: If the reason for eating late at night is a late training session then no. In fact, it will do you more harm not to eat than to eat a carbohydrate meal. The same is also true of athletes who have had a number of training sessions during the day, and have struggled to get many opportunities to eat.

However, if you are training on a recreational basis rather than going to bed on a heavy meal late at night try other tactics such as having your main meal at lunch time and a snack (with fluids) when you get back from training.

2-3 hours after:

- Thick crust pizza
- Jacket potato filled with beans, chicken or fish
- Rice dishes (preferably white)
- Pasta dishes

2 hours after:

- Cereal with low fat milk
- Fresh fruit or tinned fruit in syrup
- Bagel with topping
- Sports drink or diluted fruit juice

1 hour before and 30 minutes after (Pre or post exercise snack:)

- Yogurt (2)
- Energy, cereal or breakfast bar (2)
- Sports drink
- Pretzels (2 handfuls)
- Raisins (1 handful)
- Dried apricots (1 handful)
- Fruit cake (2-3 slices)
- Fig rolls (4-5)
- Low fat fruit scones (2)
- Jaffa cakes (5-6)
- Confectionery (Jelly babies, cola bottles etc)

- Juice ice lollies
- Fresh fruit **(2)** or tinned fruit **(1)**
- Low fat rice pudding **(1-2 cans)**
- Home made milk/juice smoothie **(1)**

(Indicates how much of a particular snack is required)

Combining a carbohydrate post exercise snack with a source of protein will help your recovery. This may simply involve having a glass of low fat milk with your carbohydrate snack.

Q: 'Is it possible to eat too much in recovery'?

A: It is always best to eat something than nothing at all. However, it must be remembered that recovery nutrition is designed **as an interim measure until your regular eating pattern resumes**. So if you are able to eat a main meal anything up to 2 hours after your exercise has finished, then there will be no need to 'cram in' as much recovery food as possible.

This is important where weight control or maintaining body compositions is your goal.

While for some it may be possible to 'over eat in recovery' for others this may not be the case. This is true where exercise affects appetite - delaying an athlete from resuming a normal eating pattern for some time after (i.e. more than 2 hours) exercise has finished. In this case it is not possible to over eat, and smaller quantities of recovery foods and nutritious fluids (milks or meal replacements) are required.

Tips for Recovery:

- You need 1g of carbohydrate per Kg body weight, every hour after exercise until normal eating pattern can resume.
- 1 Recovery snack on this worksheet is equivalent of 50g carbohydrate. So if you are 120 Kgs you will need 2½ recovery snacks every hour.
- If your goal is weight control or leanness, keep your recovery snacks to the healthier options (fruit, milk, yogurts etc)

Fluids and Hydration

Exercise increases the production of heat from your body; sweating helps to cool you and prevent over heating. When you sweat water is lost from your body. If this is not replaced dehydration occurs, body temperature rises, performance suffers (both skill and aerobic) and heat stress can result which can be dangerous to your health. For this reason hydration should be the main priority during training.

Types of fluid

There are two types of drinks, fluid replacement drinks (Hypotonic and istonic drinks) and energy drinks (hypertonic).

Hypotonic drinks contain very little carbohydrate (less than 4gms per 100ml), and their primary function is to replace water back into the body. i.e. They do not supply energy. Examples include low calorie sports drinks e.g. Isostar light, Lucozade low calorie sport or dilute low calorie squashes or diet drinks. These drinks can be useful on rest days for example where calories need to be controlled but fluid intakes encouraged.

Isotonic drinks have a dual purpose both hydration and energy provision. They typically have 4-8g of carbohydrate per 100ml and their composition means that they are absorbed quickly into the small intestine. Examples include; dilute fruit juice (1:1), diluted squash (1:4) Lucozade Isotonic, Gatorade, Poweraide etc.

Energy or hypotonic drinks

These contain relatively high amounts of carbohydrate (8-20g carbohydrate per 100ml). They usually contain very little sodium and are emptied more slowly from the stomach and absorbed slowly from the small intestine. Examples include; Lucozade Energy, Virgin High Energy, undiluted fruit juice, Purdeys, Red Bull.

These drinks are potentially useful over periods of intensive training where carbohydrate demands are very high. For example they can aid recovery after training or in between periods where matches are close together. **However**, these drinks do not help fluid replenishment so need to be taken with plenty of hypo or isotonic fluids. Failure to do so will potentially make an individual more dehydrated as a result of the high carbohydrate contents of the drinks.

Q: When is water the best drink?

A; For any exercise lasting less than 60 minutes. This is also true where weight loss is the main goal and training is longer than 60 minutes (but less than 90 minutes). In both these circumstances it is better to focus on a good dietary routine leading up to training than looking for alternatives to water. Water has the advantage of being free, and widely available. It is also the best option if you want to pour it over your head to cool yourself down, or give your mouth guard a quick wash.

For any exercise lasting above 60 minutes, then it may be necessary to consider a carbohydrate containing drink. This may also be necessary where training sessions are only 60 minutes long, but are done every day at a very high intensity.

Exception to the rule: *Drinking enough fluid is the main aim. If you prefer the taste of carbohydrate drinks and it stimulates you to drink more fluid then go for it!*

Some sports drinks are very sweet; this can also cause the reverse and make people drink less. Many people dilute these drinks but in doing so do not get the real benefit of what they are paying for. In this case it may be better to make your own drink which you know you will like and does not cost the earth

Estimating your Sweat Loss

The simplest way to check your sweat losses is to weigh before and after training sessions or events. You will need to make sure you have towelled yourself down and in minimal clothing (i.e. shorts and t-shirt). Try to ensure you weigh yourself in the same place, as sometimes uneven floors give inaccurate readings. For every 1 Kg in body weight you lose replace 1 litre (2 pints) of fluid.

Prevention is always better than cure. For this reason use other indicators such as urine colour and frequency of urination. The darker your urine and the less volume or frequency of urination the more dehydrated you are.

Thirst is a poor indicator of hydration and should not be used.

It is important to remember that children and teenagers lose fluid more readily than adults so closer monitoring of this age group is essential.

Alcohol and Hydration

Alcohol is not a fluid you should rely on for any part of your hydration. Before taking alcohol it is essential that you have fully recovered from exercise with the appropriate amount and type of fluids (based on weight), and recovery food. You should never drink alcohol on an empty stomach, or following injury in a game or training as it can delay the healing process.

Q: What should I drink when I go out?

Firstly if you are under 18 it is illegal to buy or drink alcohol from a public place. What you drink and how much you drink should be based on your individual goals and personal tolerance. Alcohol provides empty sugar calories so if weight or fat loss is your goal, alcohol intake should be limited and not be swapped for more nutritional products in your general diet. Even if these are not your goals it is important to remember that alcohol delays reactions and could affect your performance in training or in the game the following day.

As a rule, if you are going to drink it is wise to drink normal strength beers or lagers. Stay away from 'alcopops' and shorts, which given their alcohol and fluid volume will potentially give more problems from dehydration than drinks of a greater fluid volume and smaller alcohol content.

D.I.Y. sports Drinks

Hypotonic drinks

(Ideal for re-hydration)

100ml ordinary fruit squash
900ml water,
Pinch of salt

Or

250ml unsweetened fruit juice
750ml water
Pinch of salt

Isotonic Drinks

(For re-hydrating and some refuelling)

200ml ordinary squash
800ml water
Pinch of salt

Or

500ml unsweetened fruit juice
500ml water

Practical tips for drinking

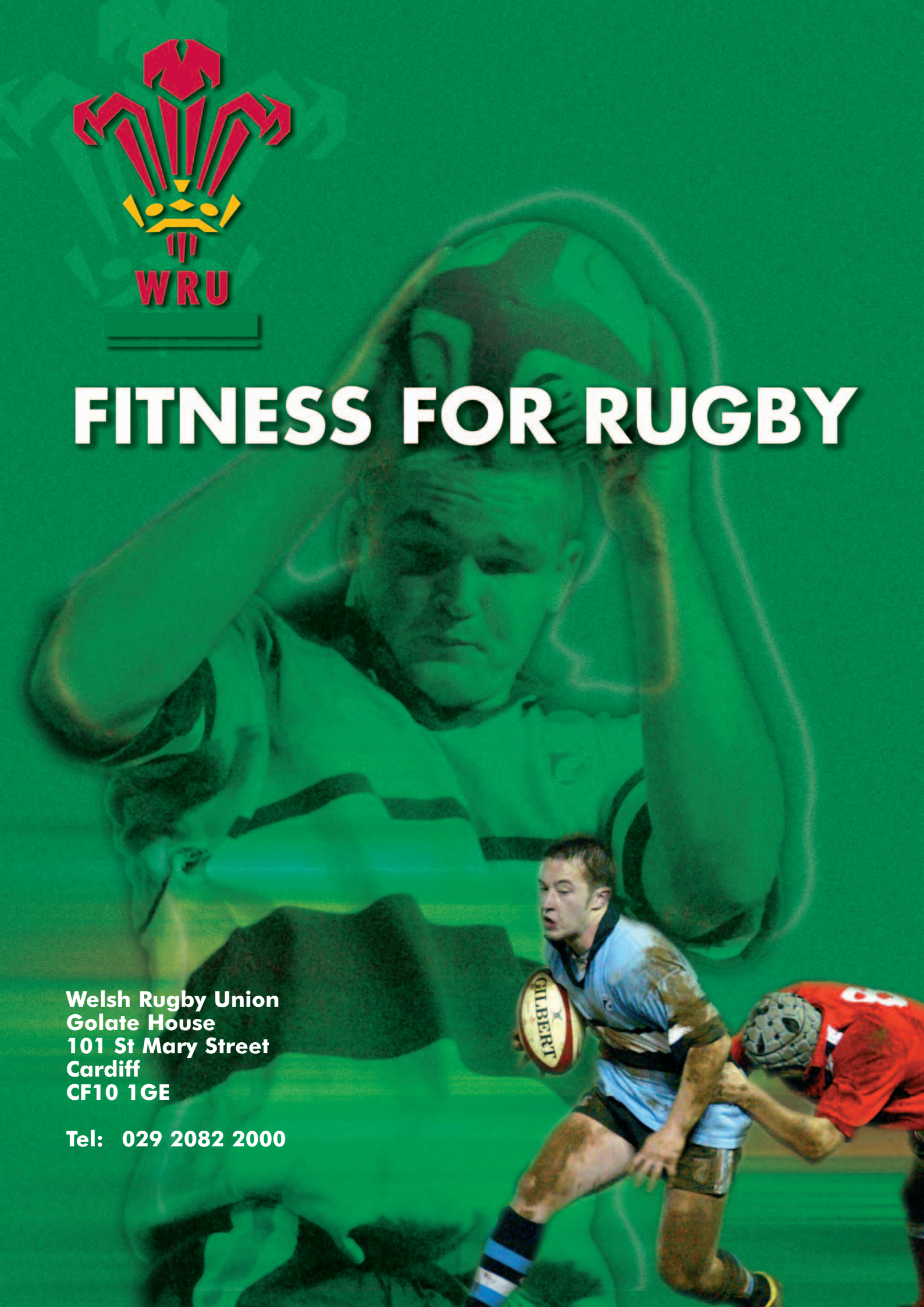
- You should not use thirst as an indicator of dehydration. By the time you are thirsty it is likely that you are irreversibly dehydrated.
- You can get dehydrated in cold and wet weather.
- If you tend to spit a lot of fluid out during training, use bottles with just water in for spit bottles and then save the other bottle for drinking. This will help you get a more accurate idea of how much you are drinking.
- Make sure that bottles containing just water and those containing carbohydrate drinks are clearly identified.
- When training, take some fluid prior to starting.
- Identify the most user friendly drinks containers for your event. These may have to be squeezable ones for runners, cyclists or tri-athletes.
- Don't rely on others to provide fluids always take your own.
- Try and use your own named drinks bottle to enable monitoring of how much fluid you have.
- In extremely hot conditions it may not be possible to replace all of your sweat losses. Do the best you can do.

Simple steps to effective hydration

- Start the session well hydrated.
- Make sure that you've replaced fluid losses from your last exercise session.
- Have a drink 10-15 minutes before the start of your workout.
- Don't rely on visible sweat as a guide for your fluid needs. Sometimes it is not possible to see your sweat losses e.g. swimming, cycling.
- Check your sweat loss during training. Weight loss over an exercise session is almost entirely due to loss of fluid not body fat. Use this information to plan your rehydration, or better fluid intake practices during sessions.
- Try to keep drinks cool, refreshing and to a taste that you like - as this will encourage you to drink more.
- Drinking at regular intervals during the sessions is the key to success.
- After exercise rehydrate quickly to your rehydration plan. You will need to carry on drinking plenty of fluid after you have finished to cover sweat and urine losses - so if you have not lost any weight over the session you still need to drink.

**** Alcohol is not classed as a rehydration fluid. Make sure you have rehydrated fully before drinking any alcohol.***

FITNESS FOR RUGBY



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