

Fitness

This section of the site is intended to provide coaches, players and the general public with information on physical fitness in relation to Rugby. It is our intention to keep you updated with the latest fitness information as it becomes available.

The content provided is divided into two sections as follows:

1. The Young Player section seeks to provide information about developing the fitness required for Rugby appropriate to the Young player. It very important to recognise the particular needs of the young player. The young player is not a mini-adult. While the young player's needs will vary from player to player, it is clear that teenagers nowadays are less physically active than their parents were two decades ago. This is readily seen in the disappearance of informal play from the lifestyle of the young player. The impact of this reduced activity in our youth poses a challenge to all of us. Therefore, it is particularly important that we expose our younger players to training methods that emphasise skill and motor fitness as opposed to intense heavy training regimes.

- Conditioning for the Young Player
- Strength Training for the Young Player

2. The second section will include general articles on Fitness covering fitness training, fitness testing, diet and nutrition, recovery strategies and other topics related to Fitness development. The content in this particular section will be suitable for the general public and the senior player.

- Recovery Strategies for the Rugby Player
- Nutrition for the Rugby Player
- To Endurance Train or not

To Endurance train or not?

- Demands of the Game
- Energy Requirements of the Game
- Specificity - An Important Principle
- Periodisation
- Unloading - Planned Recovery Periods
- Aerobic training is Useful and Important

Demands of the Game

Rugby is a multi-activity sport played over 80 minutes. The game can be described as a discontinuous, high-intensity, multi-activity sport. Each player's physique and body shape can differ dramatically and each position makes its own unique physical demands on the player. The physical fitness demands of the game include multiple acceleration and sprint efforts over distances typically up to 25 metres for players in general. The outside backs can cover greater distances at top speed whereas the forwards tend to reproduce shorter distances of explosive acceleration bursts more frequently. Multi-directional activities including weaving, running sideways, side-stepping, stepping backwards, in addition to straight line running are constantly repeated by all players. Total body encounters are frequent in the form of tackles, collisions, scrums, mauls and rucks. To cope with these demands players are required to have well-developed levels of strength, power, speed, multi-sprint endurance, agility and mobility.

In general, Rugby conditioning programmes often include aerobic or endurance training with the goal of establishing an "aerobic base". Aerobic training is generally completed in the off-season or early pre-season periods to enhance the player's ability to endure or last the game. However, training to improve a player's aerobic base may be more harmful than beneficial to the rugby player. Lets look carefully at the energy demands of rugby. This will help clarify why an emphasis on endurance training is not necessary.

Energy Requirements of the Game

High aerobic fitness levels are common in athletic events such as 5,000m, 10,000m and marathon running. The aerobic energy system contributes more and more to the energy supply of these distance events as the event distance or its duration increases. The high aerobic fitness levels noted in distance athletes are important in maintaining an unbroken, continuous speed/pace effort. Frequently aerobic fitness is measured in terms of aerobic capacity or VO₂ max. The levels found in top distance runners can range from 65 ml/kg/min to 80 ml/kg/min. The average fit male adult has a VO₂ max of approximately 40-45 ml/kg/min. The average VO₂ max for a top class sprinter can be from 50-60 ml/kg/min. The VO₂ max of Rugby players differs widely and can be from 45 ml/kg/min for heavy front row players to 65 ml/kg/min for 2nd row and back players.

How relevant is a high VO₂ max to Rugby? Remember that Rugby is not a continuous unbroken or steady state activity. It consists of multiple activities which demand constant changes in pace and intensity of effort. If you ask a distance athlete who possesses a high VO₂ max to repeatedly slow down or stop and then accelerate he will find this most uncomfortable. This is because he does not possess the muscular strength in the legs to change from a stationary position to a flat out pace or to repeatedly change direction while accelerating or decelerating. He lacks the strength and explosiveness to do this rather simple feat. In contrast doing this repeatedly is critical for a Rugby player. The reason that the distance runner lacks this type of Endurance conditioning is mainly twofold

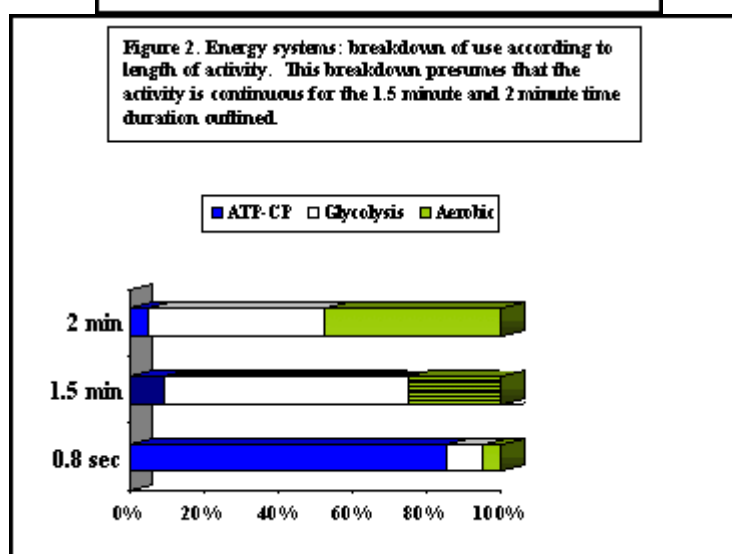
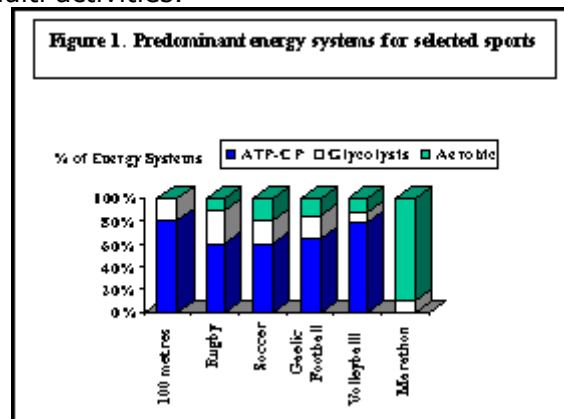
- 1) he has completed a high volume of steady paced running which blunts his speed, strength and explosiveness and
- 2) he does not complete regular speed, strength or power training.

Rugby can be classified as an anaerobic sport because of the intermittent high intensity nature of the game, with speed, strength and power activities dominating (Figure 1). The high intensity fuel required for strength, speed and power efforts has to be in good supply. Having a plentiful supply of this high energy fuel in the explosive muscles is important in rugby. This fuel comes from the ATP-PC system. In order to ensure that the explosive muscles have a good supply of this high-intensity fuel they must be trained in a high-intensity manner - using speed, strength and power as the foundation of training. The muscles must get sufficient time to recover between bouts of high-intensity sets and exercises during a training session so that the fuel stores can be replenished. Good recovery strategies must also be a feature of the weekly training programme as fatigue can accumulate over a number of training sessions. Therefore a proper mix of speed, strength, power, agility training and recovery is critical to developing the energy system required to play high-intensity rugby. Interference in developing strength, power and speed can occur if the muscles are exposed to too much endurance training. The endurance athlete in contrast relies on a different fuel store to supply energy for the endurance effort - he relies on the aerobic energy system to fuel his activity. This energy comes from a mix of carbohydrates and fats. These fuels do not supply energy fast enough to fuel a quick burst of acceleration. Figure 2 demonstrates the importance of the high-intensity fuel stores to short fast bursts of activities.

A review of the main energy systems will indicate that the anaerobic system is primarily responsible for activities that last from less than 1 second to 1.5 minutes in duration. This pathway is composed of the ATP-PC and glycolysis systems. As the length of the activity increases, the aerobic system becomes increasingly responsible for supplying energy (see Figure 2). Remember, all of these systems are functioning at the same time. The intensity and the duration determines the extent to which each is used.

While it is agreed that the aerobic system plays an important role in recovery, it is not agreed that including aerobic training in the programme will improve the performance of players involved in anaerobic sports, such as rugby. A look at the adaptations to training should suggest that the use of aerobic training for this purpose is not necessary and may limit improvements in performance.

The design of any conditioning programme must be based on an analysis of the primary energy sources and mechanical movement patterns for the particular sport. As stated the energy system taxed by endurance training is different to that required by the rugby player to complete high-intensity multi activities.



It is often suggested that an enhanced aerobic endurance capacity will enable players to meet the energy demands needed in the later stages of a game. However, few sports go non-stop from beginning to end. Game activity is likely to be disrupted by a ball going out of bounds, by fouls, breaks during play, by injuries to players and the interval break.

It is not a question of whether the player can last the game rather it is a question of how well the player can reproduce over the 80 minutes the high-intensity bouts of activity that are required of him during play.

Also, it has been reported that there is little relationship between aerobic endurance and anaerobic performance. In a recent study on the relationship between aerobic power and anaerobic performance indices, Koziris et al. found little correlation between the two. Their conclusion was that since the relationship is so poor, it is not necessary to focus specifically on enhancing the aerobic system to improve performance in anaerobic type activities.

Specificity - An Important Principle

The principle of specificity dictates that the mode of activity used in training will influence the adaptations seen in the energy and neuromuscular systems. The neuromuscular system refers to the muscles and nerves supplying the particular muscles. Aerobic activities of a slow and continuous nature tend to recruit primarily slow-twitch fibres. Endurance training adaptations will occur mainly within these fibers.

Activities of a start and stop nature that utilize the fast-twitch fibres depend primarily on the anaerobic system. The physiological changes due to start and stop type training such as speed and power training occur mainly within the fast-twitch fibres. Anaerobic training will also increase the ability to withstand higher levels of blood lactate, increase aerobic power, and thereby enhance recovery. Thus anaerobic training such as interval training will improve a players ability to recover between intense bouts of activity. It has previously been

demonstrated in rugby players that strength training alone will maintain endurance levels as well as improving speed, power in addition to strength.

Examples of Anaerobic type training include interval training. Significant increases in aerobic fitness (i.e an increase in VO₂ max) can be expected following this type of training. In addition the ability to recover from high-intensity bouts is also improved. Therefore, contrary to popular opinion it is clear that strength training in conjunction with anaerobic type training is more productive for Rugby players compared to aerobic type training.

Aerobic conditioning is generally used to help one progress to intense anaerobic training. However, due to decreases in strength and power associated with aerobic training, and the time constraints of most programmes, this may not be appropriate. By manipulating work-to-rest ratios and distances covered during interval training, one can change the intensity of the workout and still maintain the appropriate energy system adaptations and muscle fibre type recruitment patterns.

Anaerobic training is important not only for obtaining specific energy or metabolic adaptations. Activities that incorporate similar joint angles and ranges of movements, contraction modes, and speeds of contraction that are similar to the actual movement demands of the position of the player provide for essential neuromuscular development. To be prepared for Rugby competition, the player must train with Rugby specific actions and speeds. This method of training allows the gross motor adaptations gained from the strength and power portion of the programme to be refined into more applicable Rugby skills.

Periodisation

For most programmes that follow periodisation, the training year is divided into 3 periods: Pre-season, In-season, and active rest. The pre-season is generally a time to regain or increase muscle size and strength. It is not prudent to emphasize aerobic training during a period in which the goal is increased muscle strength and size, since aerobic training is associated with decreases in muscle strength, power and size.

Using interval training to enhance anaerobic endurance would be more appropriate. Interval training can be designed to be lower in intensity than sprint training while ensuring that the appropriate neuromuscular patterns are maintained. Speed training can be completed in the early and late pre-season.

The guidelines of progression should be followed, focusing on developing the ATP and ATP-PC systems for enhanced quickness, speed, and power. Many programmes proceed from a general period of higher volume and lower intensity to a specific period of lower volume and higher intensity, which may include shorter distance sprints, agility drills, plyometrics, and specific Rugby drills and activities.

The fitness goal during the In-season is to a) recover from the demands of playing and b) to maintain the strength/power and conditioning levels that were developed during the previous pre-season periods. Due to the intense nature of team training at the professional level in Rugby, a high volume of anaerobic fitness training may not be advisable during the In-season. Rugby practices may be sufficient to provide the necessary maintenance for most players. Additionally, recovery training is important as it speeds up the recovery process thereby allowing the player to commence maintenance training. A recovery session typically would take place in the swimming pool with the emphasis on low to moderate intensity swimming and post exercise flexibility maintenance. Following this maintenance training is advisable for strength and power and typically these sessions may be cycled with 1 and 2 conditioning sessions on alternate weeks.

Unloading - planned recovery periods

Unloading training or planned recovery periods between intense training periods, are important if the player is to recover and benefit from training. A planned unloading week every 3-5 weeks is recommended. The goal here is to allow the player to recover from the cumulative fatigue that will have built up over the previous weeks of intense games and recovery/maintenance training. The unloading or 'easy' week should exploit the principle of variation. This means doing different activities during training times or changing the training venue if possible but most importantly it requires a reduction in the total training volume. This will serve to ensure that the player does not overreach (a condition that precedes the debilitating state of overtraining), and this break from training will allow him to enter the next series of games and training with a renewed freshness.

Aerobic training IS useful and important

One important time for aerobic conditioning is during the unloading week and during the Active rest period. A player can engage productively in non-impact steady state aerobic activity during these periods. Also, injured players will find aerobic training effective when other forms of training are limited. Active rest is a period during which activity of a non sport specific nature is recommended. It is during this period that the player should take a complete break from his sport and the sporting environment. This gives the player the opportunity for complete recovery and rejuvenation before starting the Pre-Season for the following year. Since most programmes have restrictions governing the time a player can spend in training, it is important that every effort be made to use that time effectively.

This may not be the case if aerobic training is a component of the conditioning programme as a means of progression or to provide an aerobic base. The use of aerobic or endurance exercise in this manner is not supported by current research. In fact the data and anecdotal evidence indicates that, for most players involved in anaerobic sports, aerobic exercise may be counterproductive to performance.

Summary

Rugby is a multi-activity sport and involves brief high-intensity bouts interspersed with low to moderate periods of activity. Training to meet these demands should commence with a matching of training to the actual movement and energy requirements displayed during the game. The principle of Specificity needs to be applied when designing any fitness training programme. This helps the coach and player to be better prepared for the demands of the game. A periodised plan allows for all the demands to be catered for in a structured manner. Unloading and recovery are key elements in any periodised programme and often these are neglected. Aerobic training is useful but the coach and player should not overemphasise this form of training as it has been shown to be counterproductive to developing speed, power and strength.

Recovery Strategies for the Rugby Player

- Introduction
- Rest & Recovery during training
- Recovery following intense exercise & training
- Hyperhydration
- Recovery exercise following training and games
- Recovery breaks during the in-season
- Recovery following injury
- Recovery during the Off-season

Introduction

The concept of rest and recovery is a much neglected one in sport in general. In particular, coaches frequently do not strike the right balance between training and recovery. The recovery process cannot be over emphasised. If training takes place then it is critical that recovery follows. It is during the Recovery period or period of rest from training that the player adapts to the loads placed on him during training. In simple terms, it is during the recovery period that gains in fitness are realised. Given the right combination of training, fuel and fluids and recovery the player's fitness and performance will improve.

There are different types of recovery that a coach needs to be aware of. These include short-term and long-term recovery strategies. Short-term recovery strategies include recovery within a session to allow the player to reproduce a quality effort, recovery immediately following a session, a recovery session in itself which will speed up the recovery process. Long term recovery strategies include the off-season break from the game. This long-term recovery is essential to ensure that the player returns refreshed to the pre-season. Additional long-term rest may occur as a result of injury. This places its own demands on the rehabilitation programme.

Rest & Recovery During

Training As coaches we often make the mistake of believing that the harder the player works the better he will get. Yes, hard work is important . However, recovery is an essential

ingredient of hard work. If hard work is to be productive it must be balanced with planned recovery. For example, it is critical that recovery is planned into the session where acceleration, speed, power and maximal strength are being developed. Full recoveries are required if the player is to reproduce high quality efforts. The player will also benefit from recovery between the repetition of drills that are intended to improve a skill.

Greater detail of the rest recoveries for speed, power, strength development are given in the relevant sections on these components of fitness.

Recovery Following Intense Exercise or Training

a. Cooling down As soon as the player has completed an intense session, the recovery process starts with a cool-down. This may take 10 minutes but it is important for a number of reasons. Firstly, a gradual reduction in the level of activity is necessary in order to minimise the level of stress on the different systems of the body. Light jogging is effective as it allows the cardiovascular system to slowly rebalance. Blood pooling in the exercised limbs is thus avoided and the CV system returns to normal in a gradual manner. Stretching following exercise has been shown to be effective in reducing the risk of injury during the next session. This alone is sufficient reason for including stretching as part of a post training cooling down process. In addition, the muscles that have been worked hard can be gently stretched so as to restore their normal length during the cool down period.

It is also worth noting that the use of cold showers is more effective in the recovery process than warm showers. In fact recent evidence shows that cold water application will improve strength in the exercised limbs. If light jogging is not practical, especially after competitive games in a restricted stadium or pitch, then the player can benefit from taking a cold shower in the immediate post-game period. Ideally, a cold plunge bath is excellent at cooling the body. This used to be a very effective practice in Eastern Bloc countries following training and competition.

b. Replacing fluid loss

Body weight loss as a result of fluid and fuel loss during exercise is to be expected. During high intensity exercise and during prolonged exercise body weight loss can reach levels whereby performance is adversely affected. A loss of 2% and more can result in a reduced endurance capacity, reduced power output and can adversely affect concentration, reaction and acceleration. To reduce the likelihood of this happening players are frequently advised to drink lightly diluted carbohydrate drinks at regular intervals before, during and after exercise. However, while this strategy is somewhat effective in helping reduce the risk of dehydration it is important to have a more structured approach to pre-training and pre-game hydration and to ensuring post-training and post-game rehydration.

Following training and games weigh each player before he leaves the changing room. If the player has not attained his pre-training/game weight then he should consume the equivalent lost in fuel and fluids. For each 1 kg lost the player should drink 1.5 litres of water and eat medium to high-glycaemic index foods (fruits such as bananas and raisins) The addition of carbohydrates will speed up the replacement of fluid as well as refuelling the lost muscle fuel stores. A 75 kg player should ensure that he eats at least the equivalent of one medium to large banana in addition to the equivalent weight loss as water within 30 minutes following the training session/game.

Alternatively, lightly diluted carbohydrate sport drinks can be consumed. Consume 0.5 litres of a lightly diluted carbohydrate drink and 1.0 litres of water for every kilogram lost during training.

Ensure where possible that the foods eaten immediately post-exercise are of the high-glycaemic type. Sport drinks are considered high-glycaemic beverages. They are very useful during this post-training period, as they provide both fuel and fluid replacement but note that their consumption should be limited to the immediate post-training period, that is within 30 minutes following training. Encourage the consumption of solid foods during this period in preference to sport drinks. Fruits will provide additional nutritional value.

The consumption of sports drinks on a continuous basis throughout the day should be discouraged. The consumption of 2 litres of carbohydrate sport drinks is not uncommon. This volume of sport drinks contains the equivalent of approximately 600 calories. Presuming that the player consumes a balanced diet (where he consumes sufficient energy to meet his daily energy requirements), then the intake of additional calories from sports drinks is unnecessary.

In this situation the continuous consumption of carbohydrate drinks outside of the training environment can result in over one pound of fat being gained in one week!

Hyperhydration

Frequently, body weight losses between 2- 5kg can be found over the duration of a high level Rugby game. For a 100kg player a 2kg body weight loss is not unusual. One way of ensuring that the effects of dehydration are minimized is to ensure that players start the game in a state of 'hyperhydration'. This simply means that the players should weigh in on the morning of the game at the weight greater than normal. There is evidence to show that players who are hyperhydrated perform better than players who are at normal body weight prior to the game. The following guidelines will help your players to be well hydrated for the game.

1. Avoid coffee and alcohol in the days prior to the game
2. Ensure that the player drinks water frequently on the day before and the day of the game
3. Get familiar with the player's normal hydrated body weight
4. On the morning of an afternoon game weigh players. Ensure that each player consumes 1% of his body weight in fluid 4-6 hours prior to the game
5. This should be done after the player has eaten breakfast
6. If the kick-off is scheduled for the evening ensure that the player have eaten breakfast loaded 1% of his body weight as water and has had an afternoon snack (easy to digest carbohydrates such as cereal, bread, salad, fruit juice, biscuits, etc)

Frequently, some players find it difficult to eat normally and drink on the day of a game. This is a normal physiological reaction to the anxiety that goes with competition. To help a player who finds eating on the morning of a game a problem, a tasty shake, consumed after a light breakfast is beneficial. Additionally, the player should try to hyperhydrate on the evening prior to the game. This will help to ensure that the body weight is at least normal on the day of the game.

It is important to try out any new strategy well in advance of the big game. Therefore, the guidelines given above should be well rehearsed during the pre-season so that players are familiar with the strategy for the in-season games.

Finally, it is recommended that pre and post training and game weigh-ins become a common and accepted feature of the Rugby player's lifestyle. Ensuring that the player's post game weight returns to the pre weigh-in level before he leaves the changing room will be a very positive step towards speeding up the player's recovery.

Recovery exercise following training and games

On the day following a game players should become familiar with the practice of recovery training. This includes completing a resetting exercise programme (outlined in the Strength training section). The purpose of resetting is to restore the balance of tension and mobility into the exercised limbs. A 20 minute session incorporating a series of exercises will be effective in resetting. In addition, a hydro or pool recovery session is ideal for restoring mobility into the exercised limbs. This can be done in a 10-20 minute pool session which combines easy swimming with active stretching while in the pool. The guidelines below outline a typical pool recovery session following a game.

Pool Recovery session

- *Swim for 2-5 lengths at a comfortable pace. Then complete a 30 second stretch for the hamstrings.*
- *Swim one length again, at a comfortable pace and then stretch the quads. Again limit the stretch period to 30 seconds.*
- *Swim one length at a comfortable pace and then stretch the lower leg.*
- *Swim one length and then stretch the hip flexors.*
- *Repeat the routine for 1-3 sets.*
- *Spend 15-30 minutes at this session and after returning to the changing area and drying down take a cool/cold shower for two minutes.*

NB: If you have a 'dead leg' or haematoma (bruising in muscle) do not exercise or stretch the affected limb. Ensure that you apply PRICE: Pressure, Rest, Ice, Compression and Elevation intermittently over 48 hours.

Recovery breaks during the In-season

Due to the intense demands of training and playing during the In-season players can become chronically fatigued. This fatigue may be evident in that the player does not have the same enthusiasm for training or for the game as he previously displayed. It is also well established that players can become overtrained if training is unvaried. To help avoid the occurrence of overtraining it is important to build in regular recovery periods - or unloading weeks into the programme. It is recommended that after every 5 weeks of training and playing that the training programme is unloaded such that the player does not complete formal fitness training. In other words he takes a complete break from resistance training, speed work, interval training, the Gym and if possible has a reduced Rugby practice time. While some Rugby practice may take place, especially if there is a game planned for the weekend, some variation in the format of the Rugby practice should be considered. For example, a change in training venue is useful and provides variety of setting. A reduced practice duration from 60 minutes to 30 minutes with a football game such as soccer, GAA or Aussie rules as a warm up can be helpful in stimulating a renewed energy in players. Alternative fitness maintenance training can be completed. Instead of interval running the player could complete an interval session while swimming. Instead of resistance training in the Gym the player could take part in athletic events - jumps and throws.

The coach must constantly be aware of the mental as well as the physical well being of his young players. Guided by the principles of training the coach can creatively prepare a varied and stimulating programme of training and game practice for his young players.

Recovery following injury

Just as gains in fitness occur following a period of training, a player will also lose fitness following the cessation of regular fitness training. Detraining occurs quickly when a player incurs an injury that limits his participation in fitness training. The different components of fitness are affected in various ways. Immobilisation of a limb as a result of a fracture or severe muscle, tendon or ligament injury will result in a decrease in muscle size (atrophy) and strength and power in approximately one week. Decreases in speed also occur albeit over a longer period of inactivity.

Maintaining fitness during a period of enforced inactivity is essential. A variety of methods can be employed to stimulate the muscles about the affected joint while not exposing the injury to further damage. For example, a player with an upper limb injury may be able to employ a lower body strength maintenance workout while incorporating certain upper body strength maintaining exercises. It is important that a player attends a physiotherapist for treatment following injury. The physiotherapist should be involved in designing the immediate post-injury rehabilitation programme

Recovery during the Off-season

Rugby players at all levels are playing more frequently and intensely. As a result the Off-season period is crucial in ensuring that the player is well recovered both physically and mentally before the commencement of the next Pre-season. The off-season should provide the young player with the opportunity of taking holidays. The duration of the Off-season could be from 3-5 weeks. During the Off-season the young player may participate in sporting activities (tennis, golf, swimming, soccer, Gaelic....) which do not include Rugby oriented work. Such activities are excellent for maintaining fitness and for developing a wider range of motor fitness.

Conditioning for The Young Player

- **The Young Player**
- **Physical Fitness defined**
- **Needs of the Player**
- **Demands of the Game**
- **The Principles of Training**
- **Periodisation & Year Plan**

The Young Player

Maturation from pre-adolescent through adolescence will vary from child to child. This variation in physical, emotional and psychosocial development offers constant challenges to the teacher, parent and coach. Of paramount importance during training is safety. Safety during training and competition is enforced through good standards of care, attention and awareness. The presence of adult supervision is a necessity during training sessions in ensuring a safe training environment for the young player. This is especially important when formal fitness training is being conducted.

Physical fitness defined

Before examining the physical fitness requirements for playing Rugby it is important to clarify the meaning of physical fitness. Physical fitness is a relative term describing the level of development of one or more of the components of fitness. It varies from sport to sport. For example, being fit for Rugby implies that the components of strength, power and speed are well developed. In contrast being fit for a marathon requires a highly developed level of aerobic fitness.

Physical fitness for the Rugby player should be viewed in terms of General, Special and Specific Fitness. General fitness refers to the development of the key physical components of:

- 1. Stamina or endurance**
- 2. Strength**
- 3. Speed**
- 4. Suppleness (flexibility)**
- 5. Skill (also termed 'motor fitness')**

Another important general fitness component that should be considered for rugby is optimal body weight and body fat. There is strong evidence to show that Irish Rugby players tend to be fatter compared to their international counterparts. This is a component of fitness that needs to be addressed at the young player level.

All Rugby players will require a reasonable level of the 5 fitness components. The higher the level of play the greater the level of fitness required to meet the demands of the game. In addition it needs to be recognised that there are different fitness demands on the player depending on the position in which he plays. Special fitness training is concerned with providing training methods that link General preparation with more game related activities. For example, if a player is to transfer the strength developed in the Gym into play he should follow a progression from General weight training to special exercises (such as medicine ball training) through to position specific training. In this case medicine ball work can be seen to bridge the gap between the weight training room and the activity of the game.

Other special training drills and exercises include core training, SAQ training and power drills to mention but a few.

Specific fitness

Specific fitness is concerned with the demands of a certain position or activity. For example the specific position 'strength' required for a prop is different to the strength required by an out-half. The prop will require a very high level of maximum isometric, concentric and eccentric strength, whereas the out-half will require a good level of these strength types but his primary emphasis will be on power development.

In order to plan the type of fitness training required it is crucial that the coach understands the concept of 'Periodisation'. This is the process of planning and organising the year's general, special and specific fitness, recovery strategies and game content throughout the different periods of the year. However, before considering this very important planning process it is important to analyse the physical NEEDS of the young player and the DEMANDS of the Game. Such an analysis will provide the coach with the background information that is essential prior to filling in the training programme detail.

Needs of the Player

The development of a young player's physical fitness should focus on general motor fitness rather than on specific rugby position fitness. The latter will improve as a direct result of improved motor fitness. Motor fitness consists of four key elements namely, locomotion, balance, manipulation and awareness skills. A brief description of these elements follows: Locomotion consists of walking, jogging, cruising, sprinting, turning at pace, side-stepping, evading, running with a forward drive, moving sideways, backwards... the list goes on. Balance consists of static and dynamic balance. During static activities this means being able to maintain balance while in different stances, while being opposed by a partner or while changing direction at pace. This is best illustrated in the ability of our top international players to change direction with precision and at pace, a key quality that distinguishes top class players from average players.

Manipulation refers to the player's co-ordination skills. These include the cooperation of hand and foot movements at pace. These are best illustrated in the ability of a player to pick a ball while on the move and at the same time changing direction with precision and speed.

Awareness refers to the player's ability to judge space and time and to put together the best possible choices to exploit these.

All these elements of motor fitness can be developed. The capacity to develop these elements is most sensitive during early childhood and into the teenage years. In addition, the young player does not possess the physical maturity (bone, muscle, fuel stores) nor motor fitness base to benefit from specific fitness training. With a wide base of motor fitness and some general component development the young player will bring an impressive range of fitness abilities and skill to the senior ranks. In contrast, the adult player who has neglected the development of a wide base of motor fitness during his progress through the teenage years will firstly show promise but will over the long term be disadvantaged and he will lack the foundation necessary to perform subtle skills with precision, speed and power at top level competition.

Early 1990 studies showed that Irish schoolchildren were in general less fit than their European counterparts. They had more body fat, were less coordinated, had lower agility scores compared to age-matched European and Southern Hemisphere counterparts. Nearly a decade later these schoolchildren are now becoming the next senior rugby playing generation. During these valuable formative years the foundations of general fitness especially motor fitness were and are being neglected. Ireland also ranks at the top of the list when it comes to the problem of inactivity both in and outside of school. However and thankfully, some teenagers are more fortunate in that they are involved in one or more team sports. Their general motor fitness tends to be developed to a higher level. Support for this view is evident in the fact that many of the top performers in any given sport are also very competent in more than one sport or physical activity. By complementing participation in a wide variety of physical activities with general fitness component development a balanced fitness programme will be achieved.

As the young player grows and matures his need to develop general fitness components will increase. For example table 1 outlines a general progression of fitness component development. This shows that the key areas of development for a 11/12 year old player will include the development of motor fitness and core development. The 11/12 year old will

develop strength and power by mastering the techniques of different exercises (such as partner resistance, circuit training and SAQ drills). He will be 'learning' greater muscle strength through being able to complete a movement with efficiency. The more exercises, drills and movements that he learns the better. His fitness and all-round ability will develop as a result. The 15/16 year old can continue gaining strength from learning a greater range of exercises and drills and also from a more formal strength training programme provided he has firstly mastered the techniques of a wide variety of exercises.

Demands of the Game.

The game of Rugby places demands on technical, tactical, physical and psychological factors. While this manual focuses mainly on the physical fitness development of the player throughout the teenage years, it does recognise the importance of attending to all of the above areas. As previously stated the demands of the game will vary depending on the level of play and on the position occupied by the player. In general, Rugby can be described as:

" a multi-sprint, multi-activity sport".

It requires all players to have well-developed levels of all fitness components. While distance running training can play a part in a rugby player's training it is not the only fitness component needing attention. Rugby is not an endurance running sport. It is not one-dimensional. It is multi-dimensional. In physical fitness terms it is a sport that involves a vast array of movement and activity changes, it combines multiple sprints, grappling, wrestling and collisions, swerving and sidestepping, jumping, turning and falling in addition to the skilled activities of ball handling, kicking and passing, rucking and mauling --- none of which are really developed while completing long distance running.

This however, is not to say that aerobic conditioning should not play a role in the Rugby player's fitness training regime. Yes, it should be incorporated within the training programme but not given a primary position throughout the season. It should play a role in training during all phases - during Off-, Pre- and In-season. In particular it is important during the recovery period following an intense game or training session. During the recovery session the player can benefit from aerobic training at a low to medium intensity - completed for example in the swimming pool. During other occasions, when the player is recovering from a shoulder or hand injury, cycling or in some cases running may be appropriate for maintaining a base level of aerobic conditioning. Further, if general endurance fitness levels are considered poor then a combination of aerobic training methods such as cross training and interval training is recommended. There is good evidence, scientifically and anecdotally to support the use of these methods in improving general endurance while also improving anaerobic power. The important point from this discussion on the demands of the game is to re-establish a balance within the fitness preparation of the player.

Time-motion analysis of the game reveals that the game is indeed a multi-activity sport. Table 1 summarises the demands of the game for players under 19 years of age. Note that the duration of the game in this analysis is 70 minutes. It should also be noted that this table does not list all activities performed during a game. For example, falling, tackles made, tackles received, line out jumps, number of side-steps and number of changes in direction during one run are not accounted for in this analysis. Analysis of the game in this manner will greatly assist in the way players will be physically prepared to play in the 21st century.

Time-motion analysis. Based on the average for 3 groups; props and locks, back row, and inside and outside backs. Distances are given in metres. Frequency of each type of activity during the game is given. (Adapted from Deutsch et al 1998)

Props and locks

Activity	Total Distance	Average Dist	Frequency
Total Distance covered	4400	-----	-----
Walk	1000	14	73
Jog	3050	22	143
Cruise	363	14	26
Sprint	94	20	4

Frequency of:

Scrum	35
Mauls, Rucks	72
Intense Static Activity	104
Changes of activity	639

Back Row

Activity	Total Distance	Average Dist	Frequency
Total Distance covered	4080	-----	-----
Walk	992	13	76
Jog	2940	29	154
Cruise	368	11	33
Sprint	94	15	6

Frequency of:

Scrum	35
Mauls, Rucks	78
Intense Static Activity	113
Changes of activity	693

Inside - Backs - Outside

Activity	Total Distance	Average Dist	Frequency
Total Distance covered	5530-5750	-----	-----
Walk	1740-1660	14-22	132-120
Jog	2600-2110	16-20	159-139
Cruise	565-514	13-11	43-45
Sprint	208-297	19-24	12-15

Frequency of:

Intense Static Activity	12-9
Mauls, Rucks	12-9
Changes of activity	599-542

Some points from the above analysis are worthy of mention. Total Distance and Frequency of Activity changes Even though the total distance completed during the game was between 4000 and 5750 metres, the total number of activity changes is, for all positions, greater than 540 per game. From the above analysis the demands of the game clearly call for a predominance of multiple training activities that last no longer than 8-10 seconds in duration. This highlights the principle of 'specificity' of training. In other words Rugby training should mimic and develop the activities found in the game. While general fitness development should precede specific fitness development it has been observed that general fitness development tends to be the main focus of fitness training throughout the year in Irish Rugby while specific rugby fitness training receives less attention.

Average sprinting distance and frequency

The average distance sprinted by players from all positions ranges from 14-24 metres. This confirms the essential requirement of acceleration training for all players. Note the greater frequency of maximum effort sprint accelerations by the backs as compared to the props and locks. This emphasises the importance of acceleration and speed training for the backs. However, it does not imply that forwards should limit the time devoted to acceleration and speed training. The analysis also shows that forwards are engaged in a far greater number of intense static and dynamic strength activities compared to backs.

Strength conditioning

As forwards are engaged in a large number of repetitive intense whole body static activities, including scrums, rucks and mauls a significant amount of training will have to be devoted to developing both general and specific strength. General strength training includes circuit and weight training. Specific training should include wrestling type activities including grappling and close contact pushing, pulling and resisting. Backs in contrast are not required to reproduce the same volume of intense static activities. However, they still require this type of training. The average time spent in intense static activity varies from 4.0 - 5.6 seconds. This justifies the inclusion of maximum efforts during strength training and short intense repetitive bouts during contact training. However, before the young player progresses to maximum effort strength training he should have several years (approximately 4 years) of progressive sub-maximal strength training completed.

Past and current training for rugby has emphasised continuous type endurance training. Clearly when time-motion studies are only viewed in terms of total distance completed an incomplete picture is painted of the demands of rugby. The information presented here portrays a more realistic analysis of the demands of Rugby and consequently points to the necessity for a more varied and balanced conditioning process. The coach also needs to have an understanding of the principles of training so as to marry the training content with the needs of the player and the demands of the game.

The Principles of Training

The principles of training guide the coach in his planning of all fitness training. While these principles are well-established they are also constantly evolving as more scientifically supported information becomes available. The focus of all the principles of training and the efforts of all coaches and players is to effect adaptation.

Adaptation

The human body has an enormous capacity to adapt to the demands made on it. For example, in terms of fitness development it is well established that frequent training sessions that include long slow distance running will improve an individual's capability to run slowly for a long time. This is effectively an adaptation to the demands placed on the body. It becomes a better long distance running machine as a result of long distance running. However, adaptation is always at a cost. The cost being that all systems are trained to support this adaptation. Thus, the long distance athlete who develops a high endurance capacity will blunt speed, power and reaction abilities. The system, the human body, puts all its efforts into enhancing the system that is primarily stressed. Training for Rugby is a challenge because of the requirement to develop several fitness components. This can be done by using a periodised approach to training so that the key components required to play the game of Rugby are equally developed.

Progressive Overload

Improvements in performance will only occur when the body is stressed at a level beyond its present capacity. For example, this means that in order to get stronger you must be prepared to gradually lift more weight. Lifting the same weight week in and week out will not make you stronger. However, this does not mean that each day you should be adding more weight to the bar, far from it. Any increase in load should be applied progressively over a period of time. Overload in training the young player should be in the form of more and varied exercises and movements especially for the 11-15 year old. As the player matures overload can be effected using greater intensity of exercise (making the exercise more difficult) or by gradually increasing the number of repetitions of an exercise or activity.

In training or developing any fitness component, the coach should start at and work from the present or current level of ability in his players. There are two key elements to constantly consider before each training session - overload and gradual progression. In order to over load appropriately the coach must be aware of the individual stage of development and the needs of the young player. He must then gradually increase the work that the player is capable of completing.

Recovery

This is a most undervalued principle of training. Combining work and recovery is crucial in order to achieve development. It is during the recovery period (away from training) that the player will adapt to the loads and demands of the training stimulus. For example, it is during sleep that the player's muscles and tissues will repair and adapt. If rest and sleep are compromised then the gains that can be made from training will be reduced. In addition,

training sessions that are excessively intense and too frequent will inhibit speed and power development. Adequate recovery from exercise and the avoidance of too much and too intense training are thus vital elements in the development of not only Rugby fitness but also in the development of energy and enthusiasm for the game.

Specificity

Rugby is a total body activity that places great demands on speed, strength, power and agility. The principle of specificity states that the effects of training are confined to those systems stressed during training. As a general guideline, training is most effective when carried out in a manner that simulates the player's sport as closely as possible. However, it must also be recognised that many young players may not possess the general fitness required to develop specific game fitness. This is best illustrated by reference to the foundation of a house. It is only when the foundation has been laid that the house can be built. Likewise general fitness is similar to the foundation required to support a structure that will have to withstand the assaults of the environment. Thus it is important to start by developing the young player's general fitness and then to progress to specific fitness. This can occur through a properly designed periodised training programme where the player develops the general components during the early pre-season and then progresses to more game specific training as the pre-season progresses.

Variation

After a period of training the body adapts to the demands made on it. If training continues without variation then the body will cease to adapt and will in fact become stale. This is a common occurrence in sport training. When variation is non-existent then overtraining can take place. The player who becomes 'stale' loses his appetite for not only training but also the game. In practical terms, it is important therefore that throughout the year variation in fitness and squad training occurs. For example in strength training, the type of exercises, the number of reps and sets, the amount of rest between sets and the speed of movement will all be manipulated in order to apply overload and variation to continue the process of adaptation.

Individual differences

This principle of training implies that individuals react to training and adapt to it differently. In addition while all players may complete a similar training session those players who demonstrate high speed and power capabilities will require greater rest and recovery in their training compared to those players who are less endowed with natural speed qualities. Further, some players will improve their endurance fitness easier than others. Frequently, players who are naturally explosive will find it difficult to adapt to endurance type training. Their adaptation will not be as evident as the adaptation made by the more 'endurance' type player.

Reversibility Training

Adaptations can be lost if the player fails to maintain the training stimulus. In other words, the effects or adaptations associated with training are not permanent and when physical training ceases fitness drops steadily towards the pre-training level. The regression or detraining effect is usually less rapid than the initial increase in fitness. The good news is that a given level of fitness can often be retained with a reduced level of training than was required for its development. This has obvious implications for players during the off-season and especially for players who incur a serious injury during the season.

Interference

When strength and endurance training are carried out simultaneously it seems that the increases in strength are less than the increases that would have occurred if the strength training had been carried out on its own. This negative interaction between different forms of training is known as interference. It is of considerable importance to the Rugby coach because Rugby requires the development of several components of fitness. The principle of interference recommends that development and maintenance emphasis is given to the different fitness components. For example, during the pre-season strength, power and speed will be developed as they are the primary fitness components required to play the game. They should receive primary attention in the training programme. Endurance can be maintained while the explosive components are being developed. If endurance, however, is the component deserving of development then the explosive components should be maintained while endurance training is emphasised.

The coach needs to be aware of the principles of training. These are the principles that will guide the coach in planning the players' training and playing year. This section gave a brief

recovery, SAQ and core training. His pre-season may be longer in duration and a 6 week period is typical.

There is a crucial difference between the approach of the young player and that of the adult player during the pre-season. The pre-season is the only period when the adult player can develop his fitness. He will then concentrate on maintaining this development during the in-season. However, the young player can continue to develop fitness throughout the pre and in-season. His development will be as a consequence of two elements. His physical maturation will lead to development as will his progression in and experience of fitness methods and playing the Game.

The In-season or playing period is a prolonged period. It frequently covers at least 6 months. While there may be little opportunity for the senior adult player to develop significant general or specific fitness during the in-season the young player may develop his fitness throughout this period mainly as a consequence of maturation and exposure to exercise. To help ensure development it is important therefore to plan a period of recovery at regular intervals during the In-season. Following a period of 5 weeks of training and playing the coach should seek to have the player recover by completing a different form of exercise in place of any formal fitness training. Swimming is an ideal option as it unloads the stresses and strains from the active joints. Where a swimming pool is not available alternative exercise such as cycling is suitable. The important point is to have variety and fun built into the programme.

Examples of a typical week during each of the phases (Off, Pre and In) are outlined in Table 3 below. These serve to illustrate the variation and progression from one period to another throughout the year.

Table 3a. Example of a typical week of activity during a periodised training and playing year for a 12-15 year old.

Day	Off-season June - July	Pre-season Aug – Sept	In-season Sept-May
Monday	Swim/Games	Strength + Core + Flexibility	Strength + Core + Flexibility
Tuesday	Court game	SAQ + Speed + Fun Fitness	SAQ + Speed + Rugby (or other sport)
Wednesday	Ball skills or Fun Fitness	Strength + Core + Flexibility	Strength + Core + Flexibility
Thursday	Swim or Rest	Aerobic/Swim + Flexibility	SAQ + Rugby (or other sport)
Friday	Field game	SAQ + Mini-game	PE/Swim
Saturday	Self-selected activity	Aerobic	Game
Sunday	Rest	Rest	Recover

Strength Training for the Young Player

- Introduction
- Is Resistance Training safe for the young player?
- Programme design
- Spotting considerations
- Increase resistance slowly
- Body weight circuits and partner-resisted exercises
- Resistance exercise equipment guidelines
- Resistance training programme for 12-14 year old player
- Resistance training programme for 15-18 year old player
- Summary

Introduction

The information in this section stresses the difference between resistance training and the sports of weight lifting, power lifting, and bodybuilding. Resistance training involves the individualised prescription and performance of exercises in an attempt to make a young player stronger and more powerful. Resistance training does not have to involve the use of maximal

or near-maximal resistances or loads. The risk of injuries from weight lifting in young players may not be as dramatic as perceived. Nevertheless, in weight lifting or power lifting the object is to lift as much as possible for one repetition of a particular competitive exercise. Training for these sports consequently does require lifting maximal or near-maximal resistances.

N.B. This form of resistance training where maximal or near-maximal loads are used is not appropriate for the young player.

The goal of resistance training for the young player is to help enhance physical fitness and sport performance and to reduce the probability of injury during sport and recreational activities. Paradoxically, many competitive sporting activities that children participate in carry much greater risk of injury than strength or resistance training. The benefits of a properly designed and supervised resistance training program appear to outweigh the risks. Numerous position statements from Sport and Exercise authorities suggest that children can benefit from participation in a properly prescribed and supervised resistance training program. The major benefits include:

- Increased muscular strength and local muscular endurance (i.e., the ability of a muscle or muscles to perform multiple repetitions against a given resistance)
- Decreased injuries in sports and recreational activities
- Improved performance capacity in sports and recreational activities

Although professionals have supported the use of resistance exercise programmes for children, they have cautioned parents, teachers, and coaches about the need for proper programme design, competent supervision, and correct teaching of exercise techniques. These areas are paramount for safe and effective resistance training programmes for children. Some of the benefits (e.g., performance enhancement in preadolescence) need further study to verify anecdotal and clinical impressions. However, greater understanding has started to diminish the unrealistic fears about young players and resistance training.

Is Resistance training safe for the young player?

Much research on the topic over the past several years has demonstrated equivocally that strength gains in children occur with resistance training when compared with children who do not perform resistance training. In the late 1970s opponents of resistance training for children argued that little if any gains in strength or muscle hypertrophy (beyond that caused by normal growth) could be achieved because of their immature hormonal systems of the child. This argument appeared to be supported by the first studies, which were unable to demonstrate strength gains in children after a resistance training programme. The lack of strength changes found by various studies over the years may have been caused by poorly designed resistance training programme or poor experimental designs. Building on previous scientific studies, more recent investigations provide evidence showing that muscular strength improvements are indeed possible in children, including preadolescents.

Recent research clearly demonstrates that resistance training of preadolescent boys can result in significant increases in strength. These studies indicate that strength gains in boys occur from performing resistance training over a wide range of ages. In addition, many of the studies state that no injuries occurred from the resistance training programmes.

Programme Design

The two most important characteristics needed to teach any activity, including resistance training exercise techniques, are patience with the young player and knowledge of the material being taught. Improper lifting and spotting techniques can lead to injury of the lifter. Therefore, knowing and teaching correct exercise techniques are very important for a safe and effective programme.

Know Proper Exercise Technique You must completely understand the technique of an exercise before attempting to teach it to others. This is especially true for multijoint exercises such as the squat. Follow up workshops will outline correct lifting techniques and all coaches are recommended to acquaint themselves with these techniques or to have access to an individual who is qualified and experienced at resistance training who will demonstrate, coach and supervise all resistance training sessions. For the coach or trainer it is essential that he studies and practices the lifts that he plans to teach. When trying to learn a new exercise start with a very light resistance. Examine the exercise technique yourself by watching yourself in a mirror, or have an experienced individual (perhaps a training partner or strength coach) assess it.

Complete full range of motion

In using proper technique, the lifter performs the exercise with the fullest range of motion possible as dictated by the body position of the exercise and uses only those muscles that are supposed to be involved in the exercise. Using full range of motion means lowering and lifting the resistance as far as possible during each repetition. Using muscles that are not supposed to be trained by the exercise compromises the training effect for the muscles that are supposed to be trained by the exercise.

Constantly stress proper exercise technique

Improper exercise technique may also place undue stress on a body part, resulting in injury. This is especially true in exercises involving the lower back and the use of heavy resistances, such as squats or dead lifts. A player can also injure the lower back while performing arm curls or shoulder presses if he uses a rocking motion of the back to initiate movement of the resistance. When the young player uses improper exercise technique, it's usually because he either is trying to lift too much weight or he loses concentration on proper form. Improper progression in resistance can also cause improper technique and possible injury. Improper progression in resistance many times is due to the increases in resistance being too great or occurring too soon in the training programme.

Spotting Considerations

Know Proper Spotting Technique Good spotting technique is vital for a safe resistance training programme. The following box provides a checklist that spotters should use at all times

SPOTTING CHECKLIST

1. Know proper exercise technique
2. Know proper spotting technique
3. Be sure you are strong enough to assist the lifter with the resistance he is using
4. Know how many repetitions the lifter intends to do
5. Be attentive to the lifter at all times
6. Stop the exercise if technique is wrong. Have the lifter practice the exercise with little or no resistance.
7. Know the plan of action if a serious injury occurs.

The goal of correct spotting is to prevent injury. A lifter should always have access to a spotter. You and the young player should know correct exercise and spotting techniques for all exercises performed in the training program, and when possible, the young player should spot each other on exercises that require spotting. If the young player cannot spot one another, as may be the case in some situations (eg. classes in which training pairs are unequal with regard to strength), enlist the help of other adults or reduce the number of participants.

Provide Spotting and Exercise Technique Practice

When you teach a new exercise, demonstrate proper exercise and spotting techniques and discuss the major points of the techniques. Then allow each young player to try the exercise using a very light resistance. For free-weight exercises a light resistance may be a barbell or dumbbell with no resistance or added plates on the bar, or even a broomstick. For an exercise performed with a machine, using a light resistance may mean removing all weight from the machine or taking the pin out of the weight stack. After the young player attempts to perform the exercise, point out any flaws in technique. Then continue further technique practice with light resistances, which will minimize the effects of fatigue during the learning stage. In addition to practicing the exercise, all young players should demonstrate proper spotting techniques for the exercises.

You will usually need more time to teach proper exercise and spotting techniques for free-weight exercises than for exercises on machines. This is because free weights require the lifter to balance the resistance in all directions (left, right, forward, backward, up, down). Machines "groove" the exercises into one plane of movement and require little if any balancing. Still, both free weight and machine exercises are important for a well-rounded programme.

Additional time may be needed to teach proper exercise techniques for multijoint exercises.

This is especially true for free weight multijoint exercises, such as squats, because coordination of movement at several joints is needed to balance the resistance.

Attempting to teach techniques for too many exercises at once, especially multijoint exercises, will slow down the learning process. How many exercise techniques a young player can learn at one time will vary. A good starting point is seven to eight exercises, of which one to three should be multijoint exercises.

Increase Resistance Slowly

Increasing the resistance too quickly when a young player is attempting to learn proper technique will slow down the learning process and can result in injury. If an increase of resistance results in poor technique, the increase is too great. This is true for both beginning and experienced lifters.

During the initial 3 to 4 weeks of a strength training programme, the resistance that the young player can lift typically increases greatly. If the young player has previously performed the exercise, increases in resistance are smaller. These initial increases are not due to true increases in strength or power but rather to the young player learning to perform the exercise correctly. Keep this in mind as you formulate goals concerning increases in strength. If you are planning to use testing to evaluate the young player's strength or power, do not conduct the test until the player can properly perform the exercise.

Teach Proper Breathing Technique The lifter should inhale just before and during the lowering phase of the repetition and exhale during the lifting phase. During isometric training, the lifter should not hold his breath during the muscular contraction. Some breath holding will occur during the last repetition of a set but don't allow breath holding throughout a complete repetition. When a lifter holds his breath, blood pressure rises drastically. This makes it very difficult for the heart to pump blood and reduces blood flow to the heart from the rest of the body. When the breath is released, blood flow to the head and brain is reduced. This can cause light-headedness after completion of a set and even fainting, which can result in loss of control of the resistance and possible injury. Because lifting maximal or near-maximal resistances is not the object of a young player's training session, there is no need for excessive breath holding.

Provide Constant Feedback

All players regardless of age should receive constant feedback on their exercise and spotting techniques. You must provide this feedback in language they can understand. Feedback is as important after weeks or even months of training as it is at the start of a program. Without feedback concerning proper technique, it is easy for a player to gradually develop a flaw in lifting technique as resistances increase.

Encourage Symmetrical Muscular Development

Symmetrical muscular development depends upon the use of single-arm and single-leg exercises, called unilateral exercises. If only doublearm or double-leg exercises are used, called bilateral exercises, the stronger limb can compensate for the weaker one. This is especially true on most resistance training machines. Although it is natural for one arm or leg to be stronger, the difference in strength between limbs should be less than 10%. Proper exercise programming and use of unilateral exercises can reduce any drastic differences. This may reduce possibilities of injury and will promote good physical development. Although bilateral exercises are important to a programme, you should also include appropriate unilateral exercises.

Examples of unilateral exercises are single-leg knee extensions, single-leg knee curls, and one arm shoulder presses with dumbbells. A leg press or bench press for which the lifter uses both legs or both arms at the same time is a bilateral exercise.

Muscle balance around a joint is also very important. Thus, if a lifter does a quadriceps exercise during a workout, then he or she should also do a hamstring exercise. Balance of the muscles around a joint may reduce the potential for injury.

Have an Emergency Plan Prepared

Safety considerations and proper supervision are concerns of all conditioning programmes for adolescents. Injuries due to a properly supervised resistance training programme are rare, with the most common type of injury being muscle strains. The following are some possible causes of injury during resistance training:

- The lifter attempts to lift too much weight
- The lifter uses improper lifting technique
- The lifter improperly places feet or hands on a resistance training machine so they slide off of the pedals or handles
- The lifter places hands on the chain or pulley system of a resistance training machine
- The lifter places hands between the weight plates of a resistance training machine

- The lifter drops free weights or the weight stack of a resistance training machine after completion of a repetition
- Spotters are inattentive
- There is improper behaviour in the facility
- A bench or piece of equipment slides during the exercise
- Worn out equipment breaks during lifting (e.g. machine cables or pulleys)
- The lifter does not use collars on free weights
- The lifter accidentally drops free weight plates while loading or unloading a bar
- Body Weight Circuits and Partner-Resisted Exercises

As with all exercise programmes, you must take care not to overwork the players during the initial training sessions. Instruct them to perform only one set of each exercise during the first two to three training sessions. During the next two to three sessions, two sets of each exercise should be performed. Thereafter, the young players can perform the programme as outlined with three sets of each exercise.

You can use the following guidelines with either a circuit or a set-repetition format. To use a circuit format, the lifter performs one set of an exercise, then moves to the next exercise after a predetermined rest period. If two or three sets of the exercises are to be performed, the lifter performs all sets of a particular exercise before moving to the next exercise. The sets and exercises in a set-repetition format are separated by predetermined rest periods.

General Body Weight and Partner Resisted Programme
Suitable for junior players (12-14 year olds)

- The young player performs exercises in the order listed
- The Warm-up may consist of general exercise consisting of jogging or cycling or SAQ drills for about 5-10 minutes followed by a general stretching routine

Resistance Exercises

1. Push-up with core control
2. Body-weight squat - use a broom handle
3. Partner-resisted elbow curl - use a towel
4. Calf raise - on step of stairs or box
5. Partner-resisted lateral arm raise
6. Lying back extension
7. Bent-leg sit-up - without partner

Approximate Time:

Two to three training sessions per week with at least 1 day separating sessions. A total time of 25 to 45 minutes per session

Additional or Replacement Exercises:

Progression to other resistance exercises (using body weight and partner resistance) after successfully mastering body weight and partner resistance exercise techniques after 4 weeks.

Advanced Exercises:

Progression to resistance equipment exercises. Note that not all body weight-resisted exercises are simple or beginning exercises.

Push-ups and pull-ups may be very difficult if the trainee is unable to perform at least 8 repetitions. In this case, using exercise equipment will allow the lifter to progress to body weight resisted exercises. Otherwise modify the exercise so that at least 8 repetitions are possible while maintaining excellent technique.

Programme Notes

- Format: set-repetition or circuit
- Number of sets or circuits: one initially; young player progresses to three over the year
- Resistance: a minimum of 10 to 12 RM
- Rest periods between sets and exercises: 2 minutes initially; lifter progresses to 1 minute
- Repetitions per set for abdominal exercises: 20-30 · Other: The young player should move through the full range of motion for each exercise.

- Partner resistance: Partner resistance must be applied smoothly. If applying resistance becomes difficult, or if body weight exercises are too difficult or too easy to perform, have the lifter use resistance training equipment or modify the difficulty of the exercise.

Resistance Exercise Equipment Guidelines

When the young player uses resistance training equipment, several factors concerning safety must be emphasized. There should always be adult supervision of the programme and facility. The equipment must physically fit the player, and you must continually stress spotting and proper technique. You must maintain proper conduct in the resistance training facility and have adult supervision at all times. The lifter must control the resistance throughout the entire range of motion of an exercise, and increases in the resistance must be controlled and gradual. Finally, you must individualize programme progression for each exercise. These factors ensure the safety of the trainees and prevent damage to equipment.

The player's age and resistance training experience will impact the programme. A 16- to 17-year-old may be able to perform the entire programme, whereas a 14- to 15-year-old may have to limit the exercise programme to three or four multijoint exercises and a few selected single-joint exercises in order to tolerate the workout. Because an example programme can only act as a guideline, examples will either overshoot or undershoot most individuals' abilities to perform the programme as well as tolerate and recover from the physical stress imposed by a workout. You must assign programmes that are appropriate for the player's age and experience. Use sound judgment, and monitor the training sessions as each player progresses to more advanced training programmes. Initially, alternate the order of exercise between muscle groups. Use additional or replacement exercises to make the programme more advanced and to provide variety.

Resistance training programme for 12-14 year old player

The programme outlined below is suitable for a 12-14 year old player only if the the young player has completed the general body weight and partner resistance programme as outlined above. Only then should he progress to the next level.

Guidelines:

- The lifter performs the exercises in the order listed.
- The warm-up: should consist of general exercise consisting of jogging or cycling or SAQ drills for 5-10 minutes followed by a general stretching routine.

Resistance Exercises

1. Bench press - using machine or light dumbbells
2. Leg press or back squat - using bar only or broom handle
3. Arm curl - use barbell
4. Knee curl (using one leg at a time or both legs at once)
5. Overhead press - with split leg support using bar only or broom
6. Knee extension (using one leg at a time or both legs at once)
7. Lat pull-down - use machine
8. Calf raise - use dumbbells or machine
9. Bent-leg sit up - without partner assistance

Approximate Time

- Two training sessions per week with at least 2 days separating sessions
- The total time will be between 25 and 55 minutes per session

Additional or Replacement exercises

- Dumbbell exercises (Lunge, arm curls)
- Seated Row
- Triceps pushdown or extension
- Internal and external rotator cuff exercises using rubber bands and/or small dumbbells
- Core exercises using physio ball

Advanced Exercises

- Clean pull from the thigh or knee level

Programme notes

Format: set-repetition or circuit

Number of sets or circuits: one set of each exercise for the first six to nine training sessions, two sets thereafter

Resistance: 12 to 15 RM initially

Rest periods: 2 minutes between sets; lifter progresses to 1 ½ minutes

Repetitions per set for abdominal exercises; 20-30

Other: The lifter can choose half of the listed exercises and add one exercise per training session until all the listed exercises are performed. The lifter should increase resistances slowly and in small increments.

Stress proper lifting techniques all the time. When adding or replacing exercises, be sure the lifter has learned proper exercise technique before you allow increases in resistance. If an exercise is replaced, make sure that the muscles that it trains are used in other exercises so that proper muscular development is balanced

Resistance training programme for 15-18 year old player

The following resistance training programmes are suitable for the 15-18 year old player who has completed a minimum of two years of the above programmes. There must at all times be supervision during these programmes and as the player may not be under your direct supervision (ie during the summer months) it is imperative that his programme is supervised by an experienced adult.

In addition all players need to stress the development of the core and back. Note that these exercises will be covered in another section. In addition, a general all-round development of upper and lower body should take place. The following programmes are examples of a progression of development from early pre-season through to the in-season.

Pre-season 1 Programme

The following programme assumes that there are 10 weeks in the pre-season period. This will run from late June to the end of August. The period is divided into two sections or sub periods. The early period which introduces the player to formal resistance training and a later period which allows the player to further develop his strength by changing the loads used and the format of the programme.

The following programme is suitable for weeks 1 through to 5. Take a week off (week 6) and then move to Pre-season 2 for the remainder of the period. This will effectively mean that period 2 will be 6 weeks in duration.

The warm-up should consist of general exercise consisting of jogging or cycling or SAQ for about 5 minutes followed by a general stretching routine.

Resistance Exercises

1. Bench press - progress to barbell on bench rack and include incline press
2. Squat or leg press - vary between dumbbells and barbell
3. Shoulder Press using dumbbells and barbell
4. Hamstring curl using machine
5. Seated row using machine
6. Leg/Knee extension using leg weights or machine
7. Arm curl using dumbbells and barbell
8. Abdominal exercise
9. Core exercise(s)

Approximate Time

Start with two sessions per week and progress to three training sessions per week with at least 1 day separating sessions. The total duration of the session will be 45-60 minutes. Period 1 will be 4-5 weeks in duration

Additional Injury-Prevention Exercises

- Shoulder rotator cuff exercises
- Calf raise
- Hip Abduction & Adduction

Additional or Replacement Exercises

- Dead lift
- Lat pull-down
- Lunge
- Front squat
- Narrow-grip bench press.

Exercise movement speed:

All exercises should be completed with a slow controlled movement. Count 1,2,3 to raise and 1,2,3 to lower.

Advanced Exercises

The lifter should perform no more than eight repetitions per set using 8- to 10-RM resistance for advanced exercises. If an advanced exercise is used, it should be performed at the beginning of the training session. Advanced exercises include:

- Power clean or clean pull from knee or thigh level
- Power snatch or snatch pull from knee or thigh level

Early Pre-Season Programme Notes-

Format: set-repetition Number of sets: two

Resistance: 12-15 RM

Rest periods between sets and exercises: 2 minutes

Repetitions per set for abdominal exercises: 20 to 30

Pre-season 2 Programme

Following the pre-season 1 programme the young player should take a week break from formal training. This will allow the young player to overcome any initial effects of fatigue and it will ensure that he will not overtrain. On his return he can progress to lifting slightly heavier loads. The increase should not be so heavy that he can only complete 1-7 reps. Always ensure that the player is capable of lifting the load at least 8 times. The player will require longer rests between sets. The number of sets will increase to three and so the player will spend from 60-70 minutes completing this programme. *Italics indicate exercises that can be periodised for resistance within this training phase.* Warm-up using general exercise consisting of jogging or cycling or SAQ drills for about 5-10 minutes followed by a general stretching routine.

Resistance Exercises

1. Bench press
2. Back squat
3. Upright Row
4. Lat pull-down
5. Hamstring curl
6. Reverse elbow curl or elbow curl
7. Abdominal exercise
8. Shoulder internal rotation and shoulder external rotation
9. Core exercise(s)

Approximate Time

Three training sessions per week with at least 1 day separating sessions. The total time will be 30 to 70 minutes per session.

Additional Injury-Prevention Exercises

- Calf raise
- Additional shoulder rotator cuff exercises
- Knee extension

Additional or Replacement Exercises

- Narrow grip bench press
- Seated row or bent-over rowing
- Wrist curl
- Dead lift

Exercise movement speed

The loads used during this phase will increase. The lifter should move the weight under control at all times

Advanced Exercises

The lifter should perform no less than 8 repetitions per set using 8- to 10-RM resistance for advanced exercises. If an advanced exercise is used, it should be performed at the start of the training session.

- Power clean or clean pull from knee or thigh level
- Power snatch or snatch pull from knee or thigh level

Pre-season Programme Notes:

Format: set-repetition

Number of sets: three

Resistance: 8 to 10 RM

Rest periods between sets and exercises: 2-3 minutes

Repetitions per set for abdominal exercises: 20 to 30

In-Season-Programme

The In-season period may be as long 30 weeks for some players. It is important to ensure that an unloading week occurs every 6th week. This means that out of 30 weeks the player will have a cumulative of 5 weeks unloading or recovery from resistance training. The player is encouraged to complete a resetting programme early in the week and then one other resistance programme later in the week. A resetting routine consists of dumbbell and core stabilisation exercises and such a session is recommended on the day following a game. Remember that the demands of the game are such that the player's balances are constantly being upset during the game. This routine is appropriate for assisting the player in his recovery and focuses on restoring the balance between the different muscle groups. The smaller muscles will receive attention in this routine.

Resetting session

Warm-Up-General exercise consisting of jogging or cycling or SAQ for about 5-10 minutes followed by a general stretching routine.

1. Dumbbell bench press with core control
2. Split standing alternate dumbbell press
3. Core exercise - bridge - holding for 5 and repeat
4. Prone bench lateral raise - dumbbells
5. Forward lunge
6. Alternate arm curl - using dumbbells and ensuring good core control
7. Hip Abduction & Adduction
8. Back extension - using physio ball or resistance machine

Developmental session

The second session during the week consists of an all-round strengthening routine. The player can alternate between option 1 and 2. Option 1 can be completed during one week while option 2 can be completed the following week and so on. This will add variety to the strength programme.

Option 1

1. Back squat
2. Bench press
3. Upright Row
4. Hamstring curl
5. Arm curl
6. Knee extension
7. Shoulder internal rotation
8. Shoulder external rotation
9. Abdominal exercise

Option 2

1. Leg press
2. Dips
3. Hang pull
4. Hip extension
5. Chins ups
6. Lunges or step ups
7. Shoulder internal rotation
8. Shoulder external rotation
9. Abdominal exercise

Approximate Time:

Complete a resetting session and one of option 1 or 2 per week with at least 1 day separating the sessions. Resetting session will take 20-30 minutes while the strength session will take 30 to 50 minutes.

Additional or Replacement Exercises

- Incline bench press
- Seated row
- Lat pull-down
- Front squat
- Calf raise
- Narrow-grip bench press

Advanced Exercises

The player should perform no less than eight repetitions per set using an 8- to 10-RM resistance. If an advanced exercise is used, it should be performed at the beginning of the training session.

- Power clean or clean pull from knee or thigh level
- Power snatch or snatch pull from knee or thigh level

In-Season Programme Notes

Format: set-repetition or circuit

Number of sets or circuits: two to three, depending on the goal. Two sets will suffice for strength maintenance and three sets may be used for strength development.

Resistance: 8 to 15 RM

Rest periods between sets and exercises: 1 to 2 minutes

Repetitions per set for abdominal exercises: 20 to 30

Summary

Resistance training or strength training is appropriate for the young player provided the guidelines recommended here are followed. It is imperative that the coach ensures that there is competent adult supervision present at all times during any resistance training session. This is essential in ensuring a safe training environment for the young player. This poses a resource management challenge to the coach. However, with thought and careful planning a safe enjoyable and productive programme can be implemented.