Resistance Training in Football: Some Practical Considerations

By Dr. John Iga

Despite early scepticism resistance training is now viewed by many coaches as an integral part of the physical preparation of football players. The early prejudices may have stemmed for the misconception that by resistance training a player may become 'too bulky', losing flexibility and agility. Scientific evidence has challenged these notions; it is now known that when correctly applied, resistance training methods may be used to enhance athletic performance and assist in the prevention of and the rehabilitation from injury.

In this article, some guidelines are given that may help the football coach design and integrate resistance training programmes into the training routines of adult football players. Initially the different objectives of resistance training (specific to football players) are defined. Consideration is then given to the structuring of resistance training throughout the training year prior to discussions of the different types of exercise that may be selected as part of a strength training programme and to the testing of strength and power.

Strength and power training for football

In the context of resistance training, the terms strength and power are often been used synonymously. However, the two terms refer to two different aspects of muscle performance. Muscular strength can be defined as the muscles ability to generate maximal force (or torque) in a single voluntary action, whereas power can be defined as the muscles ability to generate force quickly.

To achieve optimal gains in muscular strength and power, different training methods should be applied. Generally, to develop muscular strength, relatively heavy loads should be lifted in a controlled manner through the full range of motion in a joint. To develop muscular power, lighter loads should be lifted in an explosive manner (see Table 1).

In some situations it may be necessary for some players to build muscle mass (hypertrophy training). For example, a player making the transition from youth to senior football may benefit from increasing his/her muscle mass to allow them to cope with the greater physical demands of 'open age' football. In such instances, compared to maximal strength training, slightly lighter loads should be used and shorter recovery allowed between sets.

Plyometric exercises (that is exercises in which a muscle group is first subjected to a pre-stretch prior to contraction), can also be used to develop power. The type of plyometric exercise selected should reflect the specific aim of training. For example, if the aim of training is to improve vertical jumping performance then a range of jumping exercises that emphasize vertical movement should be utilised. Conversely, if the aim of the plyometric training programme is to improve agility, a player may benefit from performing a range of diagonal hops and jumps.

Guidelines for muscle strength, hypertrophy and power training football players

Training goal	Repetitions and loading	Number of sets	Length of recovery period between sets
Strength	3–6 RM loading	2-3	2–4 min
Hypertrophy	6–12 RM loading	2-3	30–90 s
Power	30% 1-RM	3–5	3–5 min

RM loading – the maximum load a player can for a given number of repetitions
% 1-RM – percentage of the maximum load that a player can lift in one repetition with good technique

Table 2. Guidelines for plyometric training football players

Intensity	Repetitions	Number of sets	Length of Recovery Period
Low	4–10	2–3	30-60 s
Medium	4–12	2–3	1–2 min
High	4–10	2–3	2–4 min

NOTE: Plyometric exercises are associated with the generation of large ground impact forces; consequently these exercises should be performed on grass or a hard rubber surface, but never on concrete. If a wooden floor is used, the players should wear training shoes with a thick strong rubber sole to help absorb the impact forces.

Tables 1 and 2 provide guidelines for maximal strength, hypertrophy and power training. When applying these recommendations always start with the lower value in the boxes. As the players become accustomed to the exercise, increase the demands placed on them by moving towards the higher values.

For the plyometrics exercises (Table 2), begin by increasing the number of repetitions performed in each set before increasing the number of sets. It is generally recommended that high intensity plyometric exercises should be reserved only for players with an appropriate strength base that is a player can squat, with good technique, the equivalent of their body mass for three repetitions.
All strength and power training should be performed at the beginning of a training session when the players are fresh. The period immediately after the warm-up is therefore a good time to undertake this training. Strength and power can be trained in the same session; however, power exercises should be performed before strength exercises.

Resistance training through the football year

The primary aim of resistance should vary throughout the football year. During the pre-competition phase (often colloquially referred to as the preseason phase) training should initially focus on the development of muscle strength. With a strength base, the emphasis of training should shift towards the training for power. There should be a progressive shift from low intensity plyometric exercises (e.g., squat jumps and power skipping) to high intensity plyometric exercises (e.g., depth jumps, double leg hops, and barrier jumps with turns). It is generally recommended that in order to develop muscle strength training should be performed 2-3 time per week.

During the playing season, training should aim to maintain the strength and power gains developed during the earlier training phase. Careful consideration should be given as to the positioning of the resistance training session, particularly if the intensity or volume (sets × repetitions) has been increased. It is well documented that an unaccustomed bout of exercise, especially if eccentric muscle actions are emphasised, may illicit delayed symptoms of muscle soreness and tenderness and impair muscle performance (strength and range of motion), possibly lasting up to 96 h after the initial training session. The symptoms of

exercise-induced muscle damage are typically reduced with subsequent training of the same type. It is generally recommended that resistance training once a week is sufficient to maintain muscular strength and power.

To prevent gross deteriorations in muscle strength and power during the transition phase (sometimes termed the off-season), some resistance training should be performed. Players with a deficit in strength or those identified as possibly benefiting from an increase in their muscle mass may also be prescribed a formal programme to follow during the transition phase. One resistance training session every two weeks may be sufficient to prevent large decrements in muscular strength and power. Table 3 provides a summary of the main focus of resistance training during the football year.

Table 3. Summary of the specific training objectives during the different phases of the training year

Phase in the training year	Resistance training goal
Pre-competition	Strength and power
	Sports and movement specific (strength and power)
Competition	Maintenance training
Transition	Activities other than sport skill or resistance training
	Hypertrophy and strength

Exercise selection

For outfield players the main focus of resistance training programme should be to develop or maintain the strength and power of the lower limb muscles (thought that is not to say that the upper body or the core muscle should be neglected). To this end, a range of exercise should be selected to train both the agonist and antagonist muscle groups about a joint. For the knee joint muscles in particular, specific attention should be devoted to training the hamstrings muscles particularly during eccentric actions (i.e., the muscle generates tension as it is lengthens).

In accordance with the principle of training specificity, to induce optimal developments in the eccentric strength, resistance training methods that emphasis an eccentric overload should be utilised. Specialised resistance training machines designed to training the hamstrings muscle during eccentric actions are now commercially available (http://www.yoyotechnology.com/sport.html). Although excellent results in terms of injury prevention and improved sprint performance have been reported following training using this device (Askling *et al*., 2002), these training machines are relatively expensive and may not be affordable at many clubs.

A variety of free- and machine-weights exercises have been recommended for training the hamstrings muscles including, back squat, hamstrings curls, lunges and dead-lifts. Although the back squat exercise is described in many text-books as an exercise that develops the

hamstrings, recent evidence has challenged these notions; it has been indicated that this muscle group does not in-fact play a major role in this exercise (Wright *et al*., 1999). The electrical activity (EMG) of the hamstrings has been found to be greater during that stiff-leg dead-lift and the hamstrings curl exercises than during the back squat, suggesting these exercises may be more effective in training the hamstrings than the back squat exercise (Wright *et al*., 1999).

An exercise that has received increasing amount of interest in recent years as a means of training to increase the eccentric strength of the hamstrings is the "Nordic" hamstrings exercise (see Figure 1). The main attraction of this exercise is that it is a simple partner assisted exercise that requires no additional equipment and can be performed with a squad of players in the "field". A significant improvement in the eccentric strength of the hamstrings muscles has been reported following training using this exercise (Mjølsnes *et al*., 2004). Additionally, one group of researchers reported a significant reduction in the incidence and severity of hamstrings injury following the incorporation of this exercise into the existing strength training routines of professional rugby union players (Brooks *et al*., 2006).

Figure 1. The "Nordic" hamstrings exercise is illustrated. The player starts in a kneeling position with ankles secured by a partner (a). Keeping the hip straight, the player resists a forward-falling motion using the hamstrings (b), and at the end, cushions upper body contact with the ground using their hands (c). The player returns to the starting kneeling position by first pushing down on the ground with the hands and then allowing the hamstrings to take over control of the movement.

Testing of muscular strength and power

Tests to assess muscular strength and power should be periodically performed through the training year. As a general recommendation, team testing should be performed at the beginning and end of the pre-completion phase, and mid way and at the end of the competition phase. Further assessments may also be performed at the end of a specific training phase and individual player testing may also be performed to monitor a player's recovery following injury, for example.

Although laboratory based assessments (e.g., isokinetic assessments) may provide a more detailed evaluation of muscle performance, these assessments may not be available to many football clubs and may prove difficult to perform with large numbers of individuals. To this end field based assessments may provide greater practical utility but also test specificity.

The maximum weight that a player can lift in one repetition with proper technique (1 RM) can be used as a measure of muscle strength. Ideally, this should be performed using free-weights but resistance machines can also be used. To maximise the player's safety and ensure good results, 1 RM testing should be limited to multiple joint exercises that involve large muscle groups (i.e., bench press and the half squat) and should only be performed by individuals who have good technique in the exercise being performed. If 1 RM testing is deemed inappropriate, the maximum load a player can lift for a higher number of can be evaluated (e.g., 3 RM). Predictive tables can then be used to estimate 1 RM based upon this information (see Baechle and Earle, 2000).

Power can be assessed, to a degree, by vertical jump performance. Three types of vertical jumps can be performed, that is the squat jump, the countermovement jump performed without the assistance of the arms and the countermovement jump performed with the

assistance of the arms. These will provide a more holistic appraisal of leg power. Performance is measured as the vertical distance jumped.

Summary

Resistance training methods can be applied to develop muscular strength and power and also induce muscle hypertrophy, if indicated. The focus of training should vary throughout the training year. In general, during the pre-competition phase the focus of training should shift progressively from strength training during the early stages of this phase to football specific power training towards the later stages of pre-competition phase.

During the competitive phase, training should aim to maintain the strength and power levels achieved during the earlier phase(s). In the transition phase, although rest should be allowed some strength training should be performed to prevent gross detraining effects. Also, during this phase some players may benefit from resistance training to elevate specific deficits in muscular strength or develop muscle mass (hypertrophy training).

Training should target primarily the muscle of the lower extremities. Care should be taken to ensure that both the agonist and the antagonist muscles groups about a joint are trained. Special attention should be paid to training the hamstrings muscles, especially during eccentric actions. Periodic assessments of strength and power should be performed; 1 RM, either directly determined or estimated, can be used to provide an indication of muscular strength. Power can be assessed via vertical jump performance.

Reference

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