

PHYSIOLOGICAL DEVELOPMENT STRATEGY FOR YOUTH FOOTBALL PLAYERS

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PREFACE

This document is a reflection of interest in science and football at Liverpool John Moores University. The institution has over 30 years of studying football, manifested in the many doctoral research students that have graduated from it and currently are work within the game. Liverpool John Moores University is also unique in having the first undergraduate BSc (Hons) degree in Science and Football. The philosophy of the Research Institute for Sport and Exercise Sciences is to bridge the gap between theory and practice, its fundamental work on training and talent development allows for application from theory to practice. The principles established can be married to applied work and translate into practical recommendations. Such conclusions are at the core of the guidelines set out in this document. The material is prepared for personnel working with youth football players. It is the intention that the guidelines are directly applicable to young players going through the development process. These guidelines have been set for young males but in most instances can be applied to young females as well.

Professor Thomas Reilly

Director of the Research Institute for Sport and Exercise Sciences,
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INTRODUCTION

The development of young football players has taken on increasing importance. To produce first team players, in addition to working on technical and tactical abilities, the developmental process must also work on a number of other attributes. These include habits and pass-times, mental skills and physical fitness.

Physical fitness in particular has received much attention in recent years. Physical fitness is composed of several aspects. These aspects are illustrated in Figure 1. Good levels in each of these aspects will allow a player to complete the activities and game skills needed throughout a match. This makes fitness training an important part of every player's training schedule. Although the various aspects of fitness can be improved through appropriate training, research has suggested that there may be optimal periods within a player's growth and development when it is best to build upon them. It is possible that if these attributes are not put under sufficient stress during these 'windows of opportunity' a player may not realise his or her full performance potential.

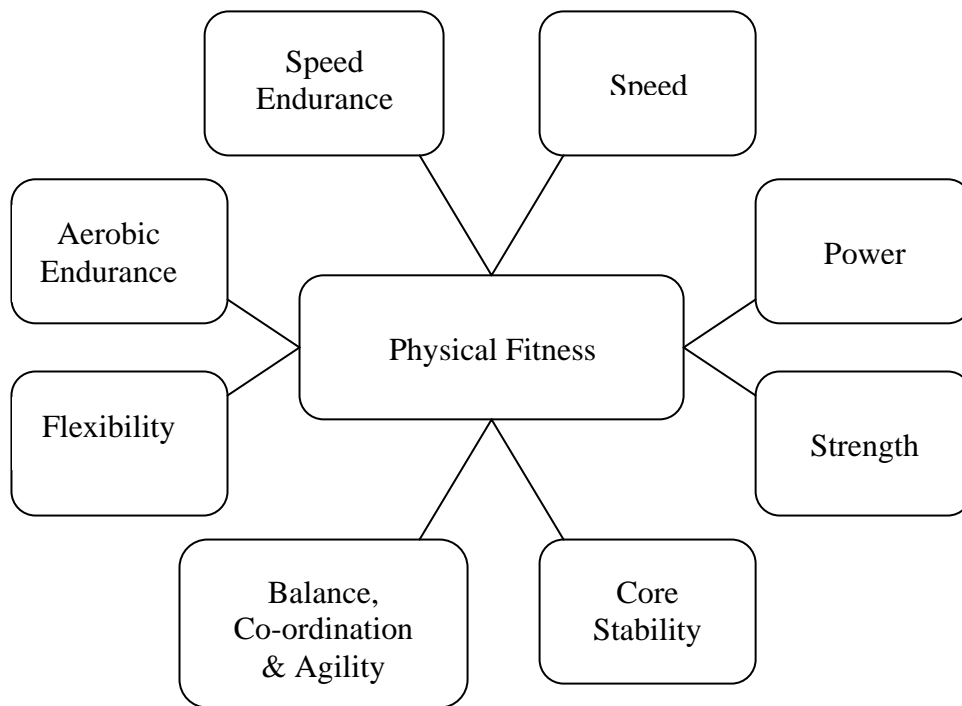


Figure 1. Range of fitness parameters for football.

This document offers in season training recommendations for physical fitness for youth football players. The guidelines are set out in a systematic manner and are given in relation to the maturity of the player (i.e., pre pubertal, pubertal and post pubertal). Considerations in aerobic and speed-endurance training are followed by specific focus on speed, strength and power training. Core stability training is reviewed prior to a focus on balance, co-ordination, agility and flexibility training. Special attention is then devoted to the assessment and monitoring of players.

In producing this report we recognise that training time is often limited and coaches may be reluctant to devote too much of this time on physical conditioning. However, with the 'smart' organisation of training several physical, tactical and technical objectives can be integrated within the same session. We recommend that, wherever possible, these training proposals should be applied within technical and tactical drills. For example, by carefully manipulating of the playing dimensions, number of players and the game rules, simple ball possessions drills can be used to provide an appropriate training stimulus for the development of aerobic endurance.

These guidelines are endorsed by the Research Institute for Sport and Exercise Sciences at Liverpool John Moores University.

AEROBIC TRAINING

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The aims of aerobic training are to:

- Increase the ability of the body to transport and use oxygen
- Improve the ability to recover after periods of hard exercise

This will benefit football performance by:

- Allowing the body to provide more energy via the aerobic energy system thereby allowing a player to work at a higher intensity during the game
- Reducing the recovery time that is required after intense periods of play before players can perform another hard effort
- Reducing the loss of technical skill performance that often accompanies tiredness

Training Prescription for Aerobic Training

Before puberty there is no need to complete any specific aerobic endurance training, as the activities completed during practice will improve the aerobic fitness of the players.

After puberty players will benefit from a more structured approach to training. Aerobic training for players at this stage of development should be based around the “Smart” principle (i.e., structuring technical training in a way that benefits the player’s physical fitness as well as their technical skill). This type of training is very effective as it is very efficient in terms of training time. It is also very specific to football. This ensures that any improvements in match performance related to training are optimised.

Tables 1 and 2 provide you with relevant information for the organisation of “Smart” training sessions that will develop the aerobic energy system. These guidelines should be used to help structure the intensity and the length of your exercise and recovery periods during your sessions.

Table 1. Guidelines for aerobic training for players in the early stages of puberty

Intensity	Length of Exercise Period	Length of Recovery Period	Ratio of Exercise to Recovery	Repetitions
65 – 90 % HR Max ¹	1 – 2 min	1 – 2 min	1:1	4 – 5

¹ HR Max refers to the maximal heart rate of the player

Table 2. Guidelines for aerobic training for post pubertal football players

Type of Training	Intensity	Length of Exercise Period	Length of Recovery Period	Ratio of Exercise to Recovery	Repetitions
Aerobic _{Low}	65 – 90 % HR Max	2 – 4 min	1 – 2 min	2:1	4 – 5
Aerobic _{High}	80 – 100 % HR Max	30 – 120 s	30 – 120 s	1:1	1 – 3 sets of 3 – 5 reps

As you can see aerobic training should become more specialised as the players develop with a need to include both low (Aerobic_{Low}) and high intensity (Aerobic_{High}) aerobic training. These two different types of training ensure that all the aims of aerobic training (listed above) are obtained.

When you start to use these tables to structure your training you should always use the lower value given in the boxes first (e.g., 2 min not 3 min). As your players become used to this type of exercise you should increase the demands placed on them by moving towards the higher values. These increases should be done in stages (e.g., 2 min increased to 2 min 30 s followed by increases to 3 min) to prevent the new training load being too hard for the player.

Do not rush the progress of your sessions, as all players will take time to adapt to any new training programme. If you try to progress too quickly your player's performance will become worse not better and your training will not be effective.

You can gradually increase most of the variables given in the table, such as the intensity, the lengths of the exercise and recovery periods and the number of repetitions. Changes to the length of the exercise period should be linked to changes in the length of the recovery period so you do not change the ratio of exercise to recovery.

When adapting your training prescription it is good to change the variables in the following order: -

1. Intensity of Exercise
2. Length of Exercise Period
3. Number of Repetitions

Make sure you do not extend your training prescription beyond the guidelines provided as this may lead to inappropriate amounts of physical stress being placed on your players. This could lead to them becoming injured or overtrained.

SPEED ENDURANCE TRAINING

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The aims of speed endurance training are to:

- Increase the ability to produce energy through the anaerobic energy systems
- Improve the ability to recover after high intensity efforts

This will benefit football performance by:

- Improving the performance of intense match activities such as sprinting
- Increasing the amount of high intensity exercise periods that can be performed in a match
- Increasing the length of time that high intensity efforts can be maintained

Training Prescription for Speed Endurance Training

There is no need to complete any specific speed endurance training with players who have not yet reached puberty, as the activity completed during training will, to some extent, improve speed endurance.

After puberty players will benefit from a more structured approach to speed endurance training. Speed endurance training for players at this stage of development should be based around the “Smart” principle (i.e., structuring technical training in a way that benefits the player’s physical fitness as well as their technical skill). This type of training is very effective as it is very efficient in terms of training time. It is also very specific to football. This ensures that any improvements in match performance related to the training are optimised.

Tables 3, 4 and 5 provide you with relevant information for the organisation of “Smart” training sessions that will develop speed endurance. These guidelines should be used to help structure the intensity and the length of your exercise and recovery periods during your sessions.

Table 3. Guidelines for speed endurance training for players in the early stages of puberty

Intensity	Length of Exercise Period	Length of Recovery Period	Ratio of Exercise to Recovery	Repetitions
Almost Maximal	20 – 60 s	20 – 60 s	1:1	2 – 6

Table 4. Guidelines for speed endurance training for players in the late stages of puberty

Intensity	Length of Exercise Period	Length of Recovery Period	Ratio of Exercise to Recovery	Repetitions
Almost Maximal	30 – 90 s	30 – 90 s	1:1	2 – 10

Table 5. Guidelines for speed endurance training for post pubertal football players

Type of Training	Intensity	Length of Exercise Period	Length of Recovery Period	Ratio of Exercise to Recovery	Repetitions
Production	Almost Maximal	30 – 90 s	30 – 90 s	1:1	2 – 10
Maintenance	Almost Maximal	20 – 40 s	100 – 200 s	1:5	2 – 10

Speed endurance training should become more specialised when the players reach post puberty. At this stage players should complete both “Production” and “Maintenance” training. Including these two different types of training ensure that all the aims of speed endurance training (listed above) are obtained.

When you start to use these tables to structure your training you should always use the lower value given in the boxes first (e.g., 30 s not 90 s). As your players become used to the exercise you should increase the demands placed on them by moving towards the higher values. These changes should be done in stages (e.g., 30 s increased to 45 s followed by increases to 60 s) so any increases are not too large.

Don’t rush the progress of your sessions, as all players will take time to adapt to any training programme. If you try to progress too quickly your player’s performance will become worse not better. It is also very important that this type of work is performed at the correct intensity. If you try and increase the training load too quickly the intensity of training that you need will be lost and your session will not achieve the desired effects.

You can gradually increase most of the variables given in the table such as the lengths of the exercise and recovery periods and the number of repetitions. Changes to the length of the exercise period should be accompanied by changes in the length of the recovery period so that the ratio of exercise to recovery is not changed.

When adapting your training prescription it is good to change the variables in the following order: -

1. Length of Exercise Period
2. Number of Repetitions

Make sure you do not extend your training prescription beyond the guidelines provided as this may lead to inappropriate amounts of physical stress being placed on your players. This could lead to injury and overtraining.