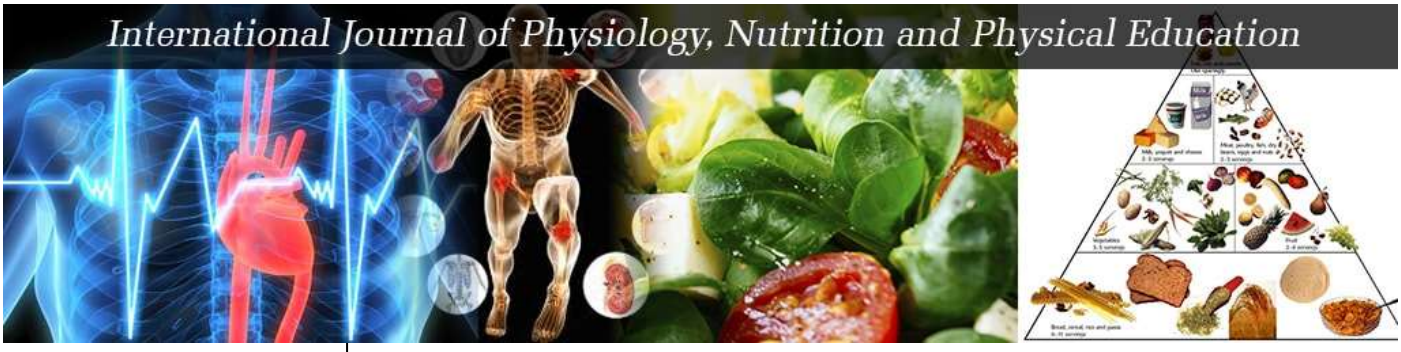

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The effect of plyometric training on agility, speed and anaerobic power of soccer players

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Abstract
The purpose of the study was to find out the effect of plyometric training on agility, speed and anaerobic power of soccer players. To achieve the objective of the study a pre-post randomized group design was used, wherein the subjects were divided into two different groups (experimental group and control group).
The subjects for the purpose of the study 20 male soccer players were selected form Lakshmibai National College of Physical Education, Trivandrum, who had at least a college level of participation The age group of these soccer players was between 18-27 years. Though there were many plyometric exercises only few of them was taken in to consideration in this study, for this study only plyometric exercises was used with a low, medium and high intensity. The agility, speed and anaerobic power in the plyometric training program for six week in the study were given by using the telemetric device, Stopwatch and Bicycle Ergometer.
To compare the effect of plyometric training on the subjects Paired sample t-test was employed at 0.05 level of significance. It was found that a significant difference in the performance of the players. Descriptive statistics: The essential descriptive statistics, which help to describe a data distribution, measures of central tendency and measures of dispersion, were calculated for summarizing the data. Paired sample t-test: paired sample t-test is used for finding significant pre-test to post-test mean differences in each group with respect to respective parameters.

Keywords: Soccer, soccer players, plyometric training, agility, speed, anaerobic power

Introduction
Soccer, more commonly known as Football, is a team sport played with a spherical ball between two teams of eleven players. It is played by 250 million players in over 200 countries and dependencies, making it the world's most popular sport. The game is played on a rectangular field called a pitch with a goal at each end. The object of the game is to score by moving the ball beyond the goal line into the opposing goal. Soccer performance is not only affected by skills, a player's physical capacity is known to exert a major influence on his match performance. The activities involved in soccer are of intermittent nature, with changes every 3–5 s, resulting in repeated high-intensity spells of play. Both aerobic and anaerobic energetic pathways are used during games. The recovery capacity of players during repeated high-intensity bouts is closely related to the development of aerobic capacity. Moreover, players' high intensity movements are positively associated with their anaerobic energy pathways. The outcome of a match may be determined by the aerobic and anaerobic capacity of players and it is therefore important to evaluate their aerobic and anaerobic capacity.

Plyometric training
To any sport that requires powerful, propulsive movements, such as football, volleyball, sprinting, high jump, long jump, basketball etc. the application of plyometric or explosive jump training is applicable. Plyometrics has been a very popular training technique used by many coaches and training experts to improve speed, explosive power output, explosive reactivity and eccentric muscle control during dynamic movements.

It is considered a high-intensity, physical training method, consisting of explosive exercises that require muscles to adapt rapidly from eccentric to concentric contractions. Plyometric training (PT) has widely been used to enhance muscular power output, force production, velocity, and aid in injury prevention.

Methodology

Selection of Subjects

For the purpose of present investigation the sample was drawn from Lakshmibai National college of Physical Education, Thiruvananthpuram, India. In total, 20 football players, having at least one year of playing experience at Inter-College, District or State level tournaments. The subjects were randomly assigned to experimental groups and a control group.

Selection of Variables

On the basis of the objectives certain dependent and independent variables are formed. All the variables of the study are mentioned below in detail.

Dependent variables (DV)

Though there are many training methods, for the purpose of the study the scholar has selected the intensity, volume, rest, repetitions and recovery as the dependent variable. These variables are considered to be the most important and most complex aspect of training in any games and sports. It is worth mentioning here in this context that there are again various types of training variables. Researcher will try to explore the low, medium and high intensity.

Independent Variables (IV)

These are the variables which the scholar wishes to manipulate and see their effect on the dependent variables. Keeping the objectives in mind, many independent variables were formed. The independent variables are anaerobic power, agility and acceleration speed. It is worth mentioning at this context, all these above mentioned independent variables will be manipulated in a simulated environment and climate condition.

Selection of Test Items

There are various tools, and methods used to measure the dependent variables, which are discussed below:

Speed test: Linear speed test

Aim: to evaluate peak and repeated linear sprinting capacity of the player.

Materials: stop watch, a measuring tape, 8-10 cones, score sheet.

Description: the player starts at gate1 with one foot on the starting line. The test leader count down three, two, one, go, then the player starts running and sprints through the 30 metres gate4, the sprint court is extended by five metres to ensure that true 30 metre sprint times are measured individually by using stop watch. In that case, two leaders should preferably measure each sprints and the average should be used as the test result.

To test the ability to perform repeated sprints the 30 metre and it can be repeated five times, each separated by exactly 25 seconds of recovery. After the first sprints the player has 22 seconds to jog back to the starting line1. Then the countdown is made. Sprint time for all five sprints measures.

The result was the time of the fastest sprints and the total time of all sprints, representing the player's ability to do repeated sprints. In addition a fatigue index can be calculated as the difference, expressed in percentage, between the fastest time and time of the fifth sprints, which provides information about the ability to maintain sprint performance.

Scoring

- Sprints : 5 times
- Recovery : 25 seconds per repetition
- Result: fastest sprints and total time of all the sprints and average of all sprints.
- Fatigue Index : (last sprint – fastest sprint)/ fastest sprint × 100%

(Anaerobic Power)

Name of the test: De Bruyn Pre-Vost test

Equipment: Ergometer, stopwatch, heart rate monitors.

Procedure

Resistance= 6times of the body weight (male)

The subject has to paddle the bicycle ergo meter with maximum effort while the resistance is fixed as per the protocol. Timing was recorded as soon as the subject starts paddling and reaches the speed of 100 bpm. Continued from there, the subject has to achieve its maximum rpm possible so as to give its maximum effort. After reaching maximum rpm he should maintain the paddling above 100 rpm for maximum possible time and test will be over once paddling speed go down to 100 rpm.

Calculation: Anaerobic power output = total duration of test /time taken to reach 100 rpm.

Testing of agility

Name of the test: the Arrowhead Agility test

Aim: to evaluate the speed, explosion, body control and the ability to change direction over a range of angles and directions.

Materials: Electronic timing equipment, e.g. Photo cells or a stop watch, a measuring tape, 6 markers (height preferably > 1.5 metres) and a pen.

Description: The markers are placed with three sets in an arrowhead shape, and one set to indicate the start and finish line. The player stands with one foot on the starting line and the other foot behind the starting line in a sprint start position. On a count down from (three, two, one, go) the players runs as fast as possible from the starting line to the middle markers (A), turn to run through the side markers(B), through the far markers (C) and back through the start/finish line. The player completes two trails, one to the left and one to the right, separated by at the least 5 minutes of recovery. If the subjects touch/steps on cones place, the test will not be valid.

Scoring: The best timing of both sides. The time is recorded in seconds to the nearest two decimal places for each direction.

Experimental/ Statistical design

The experimental design to achieve the objective of the study was used a pre-test post-test randomised Group design. The advantage here is the randomization, so that any differences that appear in the post-test should be the result of the experimental variable rather than possible difference between the groups to start with. This is the classical type of experimental design and has good internal validity. The external validity or generalaizbility of the study is limited by the possible effect of pre-testing.

Administration of the test and collection of data

The subjects were signed a consent form which indicates that they are participating in this research after knowing all the details of the study. Total 20 subjects were selected and they were randomly divided into two groups, experimental groups and controlled group, plyometric training was given to experimental group for the period of 6 weeks, three times in a week for the experimental groups and the controlled group was let free for 6 weeks.

Prior conducting the study the subjects was given introduction and demonstration of the various tests which they all are going to do. The importance of the study was told to the subjects and the doubts of the subjects were cleared. There was pre- test and post- test for the subjects. A pre-test was taken for all the groups and the scores were noted down and kept.

Once the training for six weeks is completed there was a post test for all the groups, the scores obtained from pre- test and post- test was checked and was try to find out whether there is a difference after training on the speed, agility and anaerobic power of the soccer players. Various objectives of the study were addressed on the basis of the outcomes of the following Statistical analysis.

Statistical techniques

To determine the effect paired sample t-test was calculated with the speed, anaerobic power like considered as the dependent variables. In addition, descriptive statistics such as Mean, Standard deviation was calculated. The SPSS-21.0 software was used for the analysis.

Results and Discussion of Finding

The analysis of data revealed that there is an insignificant difference in linear speed of soccer players after the plyometric training also. The most important reason for the insignificant difference on the linear speed may be attributed to the nature of physical qualities required for linear speed and efficiency of plyometric training to fulfill those demands may not be sufficient to have differences in the performance improvement in training group in compression to the controlled group. The training schedule was designed might need to have more specific exercises help to develop linear speed of the soccer players. it must be designed in such a way that it included various movements of limbs which required rapid overcoming of own body weight by extensor and flexor muscles of legs.

The analysis of data revealed that there is a significant difference in agility of soccer players due to plyometric training. The most important reason for the significant improvement on the agility may be attributed to the nature of physical qualities required for agility and efficiency of plyometric training to fulfil those demands. The training schedule was designed in such a way that it included various movements of limbs which required rapid overcoming of own body weight by extensor and flexor muscles of legs and helps in quick changing of direction to the players. The training enhances the ability of the subjects to apply force to the ball on greater proportion.

The analysis of data evident that there is a significant difference in anaerobic power also. This significant improvement may be attributed to better cardiovascular and neuro-muscular efficiency developed by the training. In order to sprint for a short distance with high intensity an individual require an ability to adjust the body according to the ball making rapid movement in different direction, this requires overcoming of body weight by the muscles primarily involved in running. During the course of plyometric training, these muscles were trained to overcome the weight with explosive movements due to the improved cardiovascular neuro-muscular coordination, increased contractile force generation capacity and ability to summate the forces at various joints during whole body movements with high intensity and rapidly as per the demand of the game.

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